A Marketing Overview for the Advancement of Atlantic Halibut Cultivation in Atlantic Canada

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A MARKETING OVERVIEW FOR THE ADVANCEMENT OF ATLANTIC HALIBUT CULTIVATION IN ATLANTIC CANADA

by

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ABSTRACT

Beibei J., Jia, L., Ridler, N., Martin-Robichaud, D.J., Shi, Y. and Sykes, P. 2008. A marketing overview for the advancement of Atlantic halibut cultivation in Atlantic Canada. Can. Econ. Rep. Fish. Aquat. Sci. 2809 iv + 56 p.

With its high retail price, Atlantic halibut (*Hippoglossus hippoglossus*) is a species that can contribute to diversification of the aquaculture sector in Atlantic Canada. There remain technical challenges in the raising of halibut, but if these and the heavy financial costs can be overcome, the species has a strong market both in North America and elsewhere.

This report initially explains why aquaculture diversification in the Bay of Fundy is desirable and some of the technical challenges in the production of whitefish such as Atlantic cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*), as well as halibut. Atlantic cod and halibut are the most feasible technically and are already being farmed in Atlantic Canada. Consumers in North American appreciate whitefish for its relatively bland taste and demand is forecast to increase because of demographic and economic factors.

The market for Atlantic halibut appears particularly promising. Supply from the capture fisheries has stagnated and it is a valuable whitefish with high fillet yield. High own price and income elasticity coefficients confirm the potential. Own price coefficients indicate that quantities can increase without a disproportionate impact on price, ensuring that halibut farmers will enjoy increased farm incomes as enhanced supplies come from aquaculture. Income elasticity coefficients suggest with rising per capita incomes the demand for Atlantic halibut will increase. Hence a farm such as Marine Harvest of Norway that is already cultivating halibut has experienced both rising sales volumes and higher prices in 2006 and in 2007.

RÉSUMÉ

BEIBEI J., L. JIA, N. RIDLER, D.J. MARTIN-ROBICHAUD, Y. SHI et P. SYKES. « A marketing overview for the advancement of Atlantic halibut cultivation in Atlantic Canada », dans *Can. Econ. Rep. Fish. Aquat. Sci.* iv + 56 p., 2008.

Vu son prix de détail élevé, le flétan de l'Atlantique (*Hippoglossus hippoglossus*) est une espèce de poisson qui est susceptible de contribuer à la diversification du secteur aquacole du Canada atlantique. L'élevage du flétan pose certains défis techniques, mais, si on réussit à les relever et si on réussit à absorber les énormes coûts financiers, le marché du flétan sera solide tant en Amérique du Nord qu'à l'étranger.

Les auteurs du rapport présentent d'abord les raisons pour lesquelles la diversification de l'aquaculture dans la baie de Fundy est souhaitable, suivies de certains des défis techniques que pose l'élevage d'espèces de poisson à chair blanche, comme la morue (*Gadus morhua*) l'aiglefin (*Melanogrammus aeglefinus*) et le flétan. Sur le plan technique, ce sont la morue et le flétan qui se prêtent le mieux à l'élevage. En effet, on les élève déjà au Canada atlantique. Les consommateurs nord-américains aiment le goût relativement fade du poisson à chair blanche, et la demande de ces espèces devrait augmenter en raison de facteurs démographiques et économiques.

Le marché du flétan de l'Atlantique semble particulièrement prometteur. L'approvisionnement provenant des pêches de capture a stagné, et cette espèce de poisson à chair blanche a un rendement élevé en filets, ce qui en fait une espèce recherchée. Les coefficients élevés d'élasticité-prix et d'élasticité-revenu confirment ce potentiel. Les coefficients d'élasticité-prix laissent croire qu'on peut accroître les quantités sans influencer le prix de façon disproportionnelle, ce qui permettra aux éleveurs de flétan d'accroître leurs revenus même s'ils augmentent leur production. Les coefficients d'élasticité-revenu donnent à entendre que l'augmentation du revenu par habitant fera grimper la demande de flétan de l'Atlantique. Par exemple, Marine Harvest, une ferme d'élevage du flétan en Norvège, a vu son volume des ventes et le prix du flétan augmenter en 2006 et en 2007.

EXECUTIVE SUMMARY

Globally, the consumption of seafood continues a positive trend. Population growth, urbanization, and increases in real per capita income will continue, resulting in higher demand for seafood. In addition, in Europe, Japan and North America, overall aging of the population will provide a further stimulus to per capita consumption. Higher real and relative prices of seafood will dampen demand but also stimulate increased production from aquaculture. On the supply side, output from the capture fisheries (except for anchoveta) has been largely stable since the mid 1990s, so any future increases in supply will come from aquaculture. In 2005 aquaculture represented 29% of the volume and 39% of the value of global fish production. Moreover approximately one-third of the output of the capture fisheries is processed into feed (for poultry and carnivorous farmed fish), so the role of aquaculture in feeding humans (food fish) is approaching fifty %.

This study analyzes the marketability of farmed Atlantic halibut (*Hippoglossus hippoglossus)* in eastern Canada, and provides insights into its longer-term market potential. In eastern Canada output of aquaculture reached 63,553 MT in 2005 worth almost US$200 million (FAO 2007). The bulk of that is Atlantic salmon (*salmo salar*) accounting for 55% of volume and 75% by value. Dependence on a single species to maintain employment, income and the viability of rural coastal communities is however risky, and diversification into alternative species offers the potential to reduce risks. One option is halibut cultivation. Halibut is attractive for a number of reasons: its relative ease of domestication, resistance to disease, high price, white meat, and high (up to 60%) fillet yield. The primary objectives of this study are as follows:

1. To explain species diversification of aquaculture in eastern Canada
2. To overview the seafood market in North America;
3. To investigate the market potential for Atlantic halibut (*Hippoglossus hippoglossus*) farmed in eastern Canada. Two other alternative species: Atlantic cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*) are also briefly analyzed.
4. To developed a marketing strategy for farmed Atlantic halibut.

According to the research, the recommendations for those three species are:

1. Farmed cod will not be able to simply regain the once dominant market share of wild cod, so the strategy for cultured cod is to differentiate farmed cod from wild cod. The strategy to rescue the situation of commercial haddock is to reposition haddock as "new" whitefish species.
2. Halibut: Developing aquaculture for Atlantic Halibut is highly recommended, and the strategy is to maintain high product quality, diversify products, especially, value added products. The market in North America is strong for the small farmed production expected.

1.0. AQUACULTURE

1.1. GLOBALLY

The role of aquaculture in meeting the demand for food fish (fish for human consumption) has been growing rapidly. It now accounts for approximately 40% of world fish consumption globally, up from about 15% in 1994. Already, in highly populated countries such as Bangladesh and China, output from aquaculture exceeds that of the capture fisheries. The growing role of aquaculture is due to stagnation in the world-wide capture fisheries, and in rising fish prices that have enhanced profitability in fish farming. While global output from capture fisheries grew at annual average rate of 1.2% from 1971-2001, output from aquaculture (excluding aquatic plants) grew at a rate of 9.1%. The latter is a faster rate not only than capture fisheries, but other animal food producing systems such as terrestrial farmed meat (FAO 2004). In 2005, world aquaculture output, excluding aquatic plants, was more than 48 million MT, having doubled over the decade 1995-2005, and increased by more than six-fold since 1984 (FAO 2007a). The value of aquaculture output (excluding aquatic plants) has shown a similar expansion, and in 2005 was worth US$71 billion, up from less than US$11 billion in 1985.

Forecasts of global demand for fishery products suggest that aquaculture output will continue to increase. Demand for food fish is primarily determined by four variables: demography, living standards, urbanization and price. World population growth rates have declined to 1.4% a year but regions such as sub-Saharan Africa continue to have high rates. This population growth alone will increase demand, even if per capita consumption of fish was to remain at its low rate of 6.7 kg per year in the region. One forecast assumes that even if per capita consumption of food fish remained at its 1995/96 level, world population growth by 2030 would generate a demand for food fish that would exceed the 99.4 million MT available in 2001 (Ye 1999). Countries such as China and India have slower population growth rates, but they have rising real per capita incomes. Income elasticity of demand for fish is higher in poorer countries, so income-induced demand, combined with urbanization, will increase demand for food fish there. If per capita consumption were to rise at historical rates (to 22.5 kg per year) demand for food fish would be 183 million MT by 2030; this would require a doubling of aquaculture output (Brugere and Ridler 2004).

Other forecasts also indicate a doubling, even tripling, of aquaculture output (IFPRI 2003; Wijkstrom 2003). An increase in the real price of food fish, as well as an increase in its relative price (compared to substitutes) as predicted by IFPRI, could even stimulate aquaculture. For while price increases will dampen demand due to a price

elasticity of demand for fish (-0.8 to -1.5), and positive cross-elasticity coefficients (at least for poultry), price rises will provide an incentive for aquaculture, spurring technological innovations and needed investment.

1.2. AQUACULTURE DIVERSIFICATION IN ATLANTIC CANADA.

Atlantic Canada, from a low base, has experienced an expansion of aquaculture faster than the world average, with average annual growth rates in output of 9.2% during 1995-2005. Output grew from 26,361 MT in 1995 to 63,553 MT in 2005 (FAO 2007a). The value of total output grew even faster and approached US $200 million in 2005.

One farmed species which has expanded particularly rapidly is farmed Atlantic salmon (*Salmo salar*). Farming of Atlantic salmon began in New Brunswick in 1979 and grew rapidly in the Bay of Fundy over two decades to approximately 100 farms. By 2005, farmed Atlantic salmon accounted for more than half of total food fish aquaculture output in the region, and more than three-quarters of total value. In 2005, the New Brunswick salmon farming industry produced 35,000 MT of fish worth almost US$160 million (FAO 2007a). Traditionally, most of the product (approximately two-thirds) has been exported to Boston and New York although appreciation of the Canadian dollar is likely to reduce this proportion. Salmon farming is the largest agro-business in the province, representing approximately 1% of provincial GDP and that does not include linkages. In 2000, about 1,700 full-time equivalent jobs were attributable to core activities within New Brunswick (Aquaculture Strategies Inc. 2001). Of particular importance to the health of rural communities is the age profile of industry employees. Three-quarters of all employees in 2000 were less than 40 years old. Salmon farming has therefore enabled young people to remain in rural coastal communities.

In addition, there are linked activities. A recent study, using international input-output data, estimated the value-added multiplier for fisheries and salmon aquaculture at 1.92 with aquaculture having higher multipliers than the capture fisheries (SINTEF 2005). Of particular note is the employment multiplier; every person-year employed in aquaculture creates an additional 0.93 person years of employment in other activities. This suggests that Atlantic salmon farming in New Brunswick generates more than 3,000 jobs, with significant impacts on provincial and municipal treasuries. The economic well-being of numerous communities therefore depends on the salmon farming industry.

However, the industry in Atlantic Canada faces economic risks, hence the need to diversify into other species. One risk factor is the small size of salmon farming in eastern Canada in relation to the major producing countries. Figure 1 illustrates the global expansion of Atlantic salmon farming. Globally, Atlantic salmon output exceeded 1.2

million MT in 2005, worth almost US$5 billion; it ranked tenth by tonnage among all the species cultivated in the world and fourth by value (FAO 2007a). The two largest producing countries, Chile (which had no recorded output until 1987) and Norway, together account for almost three-quarters of all farmed Atlantic salmon production. Moreover, both Chile and Norway, plan to double their output within the next 10-15 yr (Brugere and Ridler 2004). Atlantic Canada, on the other hand, has only 3% of the world's output.

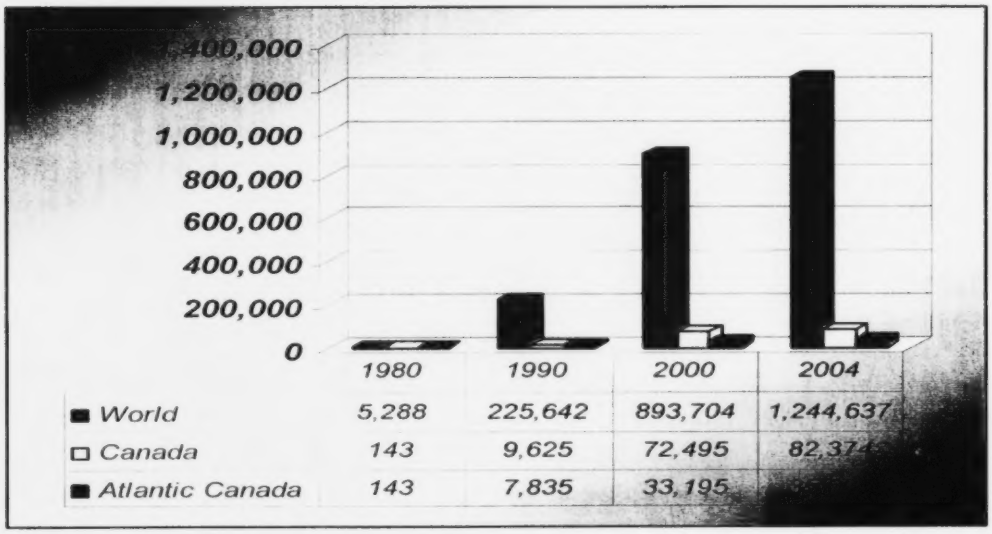

Fig. 1. Evolution of farmed Atlantic salmon output between 1980 and 2004 (MT). Source: FAO, 2007a. Fishstat FAO: Rome

In addition to geographic concentration, salmon farming is becoming increasingly concentrated industrially, being dominated by a few large corporate farms. In 2003, the four largest farms (all with headquarters in Europe) each had operations in at least five countries (SINTEF 2005). One of the four in 2003, Stolt Sea Farm, produced more salmon in Canada than the largest Canadian independent producer. The industry concentration ratio (the largest four firms as a proportion of global production) was 22%.

This concentration poses several challenges to the aquaculture industry in Atlantic Canada and therefore to employment opportunities (Auditor General 2004). In the first place, the industry in Atlantic Canada is vulnerable because it is a small player in a global market. Relying on a single species (Atlantic salmon) for revenues, and also on two markets (USA and Canada), the salmon farming industry faces considerable risks as prices fall. These economic risks are compounded by the relatively small size of salmon farms in Atlantic Canada compared with farms in Chile and Norway. The result is a commodity in which Atlantic Canada has become a price-taker, with even its largest

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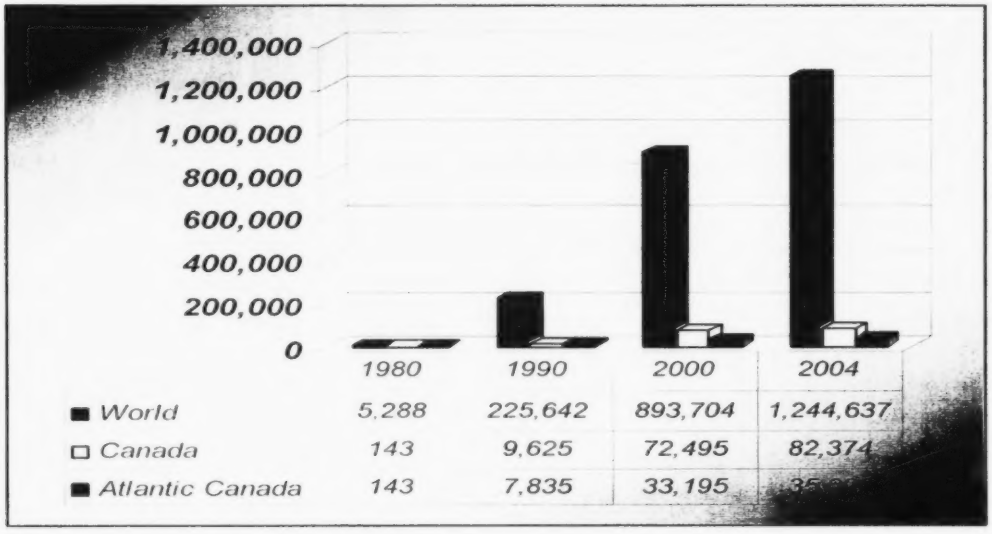

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farms lacking the resources and economies of scale to withstand market shocks.

Linked to dependence on a single species are natural risks associated with disease outbreaks or winter superchill. Infectious salmon anaemia (ISA) appeared in New Brunswick in the mid-1990s and the salmon farming industry lost millions of dollars to ISA (Auditor General 2004).

Other economic risks include food safety and food quality concerns among consumers, which translates into market resistance to farmed salmon. Negative perceptions of the industry by the public are not only reflected in consumers' preferences, but also in public opposition to site licenses. On Canada's west coast, perceptions towards salmon farming are very negative, and have forced moratoriums on new site licenses (DFO 2005). While attitudes on the Atlantic coast are more positive, largely because of the employment generated by salmon farming, media reports can cause attitudes to change dramatically (Ridler et al. 2007).

1.3. STRATEGIC ADVANTAGES OF MARKETING AQUACULTURE SPECIES

Prices for Atlantic halibut exceed those for salmon and thus make halibut a good candidate for aquaculture. As one of the premium fish species from the Atlantic region, the demand for fresh halibut has always been strong. This demand has been described as latent demand, supply never exceeding demand. North America will be the largest market for farmed Atlantic halibut. Scotian Halibut is the center of halibut production in Atlantic Canada. Located in Clark's Harbor, N.S, Scotian Halibut Ltd. produces juvenile Atlantic halibut for commercial grow out. They also run a land based grow out operation just a short distance away in Woods Harbour where they harvested approximately 40,000 pounds of halibut in the fall of 2001 (AIMS, 2006). Scotian Halibut is partnered with a large Icelandic halibut company called Fiskey Ltd. Production of Atlantic halibut in Europe is anticipated at 3000-5000 MT for European markets in coming years and will be produced predominantly by large growers such as Fiskey Ltd. and Marine Harvest of Norway (Forster 1999).

The strong market price and high demand of Atlantic halibut have been the major reasons behind its development for aquaculture. There is a link between countries that have been successful in producing farmed salmon and those that are producing farmed Atlantic halibut. In 2005 there was less then 1,500 MT of farmed Atlantic halibut in yearly production, but all were in salmon farming countries (FAO 2007a). Major players in farmed Atlantic halibut production are Norway, Scotland and Iceland. Commercial and pre–commercial activities are underway in Atlantic Canada but are progressing slowly in order to remain stable (Johnson 2002a, 2002b, 2003).

The changes that occurred to the Individual Vessel Quota in 1991 on Canada's

west coast, and how they affected the supply of fresh pacific halibut, demonstrated the price premiums and demand for fresh halibut. Continued high product quality of farmed halibut and year-round availability are the major advantages of farmed halibut. Inconsistent supply and high prices are present constraints. The availability of a farmed Atlantic halibut will allow the development of value-added products and processing facilities that will lower prices somewhat, and increase market share of Atlantic halibut.

Food fish from aquaculture have certain marketing advantages compared to seafood from the capture fisheries. Firstly, aquaculture production is demand driven and production of fresh product can be shaped according to consumer demand. Understanding the product cycles and filling consumer demand of these fresh fish products is beneficial when supply from capture fisheries is diminished or completely unavailable. Aquaculture enables product harvesting and processing under controlled conditions, allowing for advances in harvesting and processing techniques, providing the customer with the highest quality freshest product available.

By 2020, aquaculture could be the dominant source of global seafood (IFPRI 2003). Fish and seafood consumers have become more and more accustomed to the presence of farmed seafood in the marketplace, even if they are not aware what products specifically are coming from aquaculture. Over the last 10-20 yr, wholesale and retail preferences have shifted from wild-caught to farm-raised fish and seafood. Prices for the farmed products have become stable and affordable to a large segment of the population. Growth in aquaculture has accompanied a shift in the market towards value-added products that improve consumer convenience. Moreover, technological innovations, better nutrition and disease management will continue to reduce costs in the aquaculture industry. Lower production costs and increased supplies from aquaculture will hold prices down and this trend will continue well into the foreseeable future.

Secondly, although species' biological requirements must be met first when picking suitable places to situate aquaculture farms, proximity to markets can also be a deciding factor in locating farms. The occurrence of traditional capture fisheries in an area often leads to a market in that same general area, as there is generally a link to what is landed in an area and what is consumed there as well. As is the case with cod, haddock and halibut, Atlantic Canada in the past has had traditional catches of these species, and demand for these products has mostly come from the United States. Atlantic Canada, with its strong salmon aquaculture tradition and its proximity to the large northeastern US market, should be able to compete with other global aquaculture producers in the North American market.

Finally, consumers are becoming more cognizant of their purchasing power and are more concerned with the origin of their food sources. Aquaculture has the ability to

offer increased food safety, as there is more control over environmental placement and the use of sustainable aquaculture practices. Capture fisheries have the marketing advantage of saying their products are naturally grown and wild, but will also have to deal with issues surrounding overexploitation of fish stocks and inability to confirm environmental effects during the growth of their products.

1.4. TECHNICAL CHALLENGES FACING AQUACULTURE

Juvenile production has long been the major "bottleneck" to the production of Atlantic cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), and Atlantic halibut (*Hippoglossus hippoglossus*) and many other marine species (Jia et al. 2006). The complicated larval development of these species takes place under specific environmental conditions, which have taken considerable time and effort to understand and manipulate to enable the timing and production levels required for commercial culture. The use of live feeds is a required step in the early rearing of these three species, as it is an essential part of their nutritional requirements. The production of live feeds is complicated and costly. Considerable advances have been made, making live feeds more nutritious, easier to obtain and handle, as well as reducing the reliance on them as much as possible during early rearing.

1.4.1. Atlantic cod

Complete production cycles of cod have recently been completed in Atlantic Canada, and efforts are now being concentrated on making the process more cost efficient and consistent at larger scales, with the hope of making cod culture profitable. Most of the issues involve the scaling up of production that is required for profitable commercial culture. These issues are not seen as barriers to future growth but could be optimized by further research leading to better grow-out practices and increased genetic suitability of the species for aquaculture through selective breeding.

Wild Atlantic cod are used as aquaculture broodstock, and through natural selection, have developed traits that are not necessarily advantageous to culture conditions. Further insight into the genetics of Atlantic cod and broodstock development will be important in lowering production costs and increasing productivity in larger-scale operations.

Early maturation is a problem for commercial culture as energy is diverted from flesh to gamete production, thereby decreasing flesh quality and growth rates. Early maturation can require that fish be held an extra year to bring fish to market size and ensure marketable flesh quality. Early maturation may be postponed by using supplemental light, as is done in salmon farming or production of monosex stocks may

mitigate the economic impact.

Grow-out equipment requirements for cod culture are very similar to those of salmon culture. Therefore, crop switching at existing sites, from salmon to cod, could occur with very little capital investment. As cod culture intensifies and grows, diseases will increasingly become more of a threat to profitable culture. Advances in finfish health management that have been developed by Atlantic salmon culture will be an excellent starting block for the continued research that will be needed to keep ahead of the disease problems that will likely arise in cod culture.

In recent commercial harvests of cod, it has been realized that harvesting techniques may not be optimal and that pre-harvest feeding regimes and starvation periods, along with processing time frames, will require further development in order to provide a consistent high quality product.

Current status and research:

New Brunswick and Newfoundland lead the way as Atlantic cod culture is moving from pre-commercial to commercial status in Atlantic Canada. Newfoundland is a natural fit for this acclaim, having a long standing culture and tradition based around the Atlantic cod fishery. Cooke Aquaculture of St. George, New Brunswick, has completed the first "egg to plate" crop of Atlantic cod in New Brunswick. Some of this product was presented at the 2006 International Boston Seafood Show (Cooke Aquaculture, 2006) This recent development is an important step in the continuation of Atlantic cod culture and research in New Brunswick.

Cooke Aquaculture has also become a partner in The Atlantic Cod Genomics and Broodstock Development Project, along with other industry partners such as Great Bay Aquaculture of New Hampshire, USA and Northern Cod Ventures of Newfoundland. This US $18 million project that was started in 2005 will continue to progress over the next 4 yr and is very important to the development of cod culture in Atlantic Canada. The project will take place in both New Brunswick and Newfoundland under the direction of the following organizations: The Huntsman Marine Science Center in St. Andrews, New Brunswick, Memorial University in St. John's, Newfoundland, and The Atlantic Genome Center in Halifax, Nova Scotia. The focus of this project is to develop tools that will identify and allow for the selection and continuation of Atlantic cod traits that are favorable for commercial production. Some of the traits of interest to be identified and continued include: improved growth rates and product yield, better overall fish health, delayed sexual maturation and increased tolerances to temperature changes, hypoxia and other stressors. These traits will then be selected using a breeding program and will be used to produce fish suited to culture conditions, while maintaining naturally developed

characteristics that are suited to their respective regions (Newfoundland and New Brunswick). In 2009, the first generation of cod from the program will be placed in sea cages. It is anticipated that production efficiencies gained from the project will equal CAN $8 million dollars and will save $0.6 million in production costs in the first production cycle alone, based on 3000 MT of production. This project will progress as similar initiatives are pursued by organizations in Norway and Iceland.

1.4.2. Haddock

Juvenile haddock production, like cod and halibut rearing, is restricted to the use of live feeds, adding to the cost and complication of producing juveniles. The St. Andrews Biological Station (SABS) in St. Andrews, New Brunswick, was first to successfully culture haddock in captivity. SABS continues to work on haddock broodstock improvement, including environmental manipulation for year round egg production and broodstock diets that enable the production of high quality eggs for culture.

High mortality rates of cultured haddock during early rearing and grow-out has been observed and are caused by a variety of factors, making progress particularly challenging but good progress has been made to improve methodologies. As with all cultured species disease is a threat to the development of haddock culture, nodaviruses can be a notable cause of production losses. This disease, and others affecting haddock, will be dealt with by continued development of health management tools and practices, along with improved broodstock genetics. Past pre-commercial experiences growing haddock in the Bay of Fundy have demonstrated less than optimal growth rates. It will be important to further investigate these findings and improve growth rates to make commercial culture economically viable.

The commercial grow-out equipment required for haddock culture is similar to that used for Atlantic salmon. So, like cod culture, haddock culture will benefit from using tried and proven production equipment and systems that have been developed by the salmon industry.

Current status and research:

Haddock culture is in the experimental stage and has made considerable advances from its recent beginnings. However, the development of haddock culture, in terms of commercial success, is well behind that of cod and halibut. In recent years, large numbers of fish have been raised and stocked in sea cages, greatly contributing to the understanding of haddock culture while reinforcing the need for continued research and development in order to achieve commercial viability. At this time, it appears research

efforts and funding in Atlantic Canada are presently more focused on the development of cod and halibut culture, as no large industrial scale research projects on haddock culture were found to be presently underway

1.4.3. Atlantic Halibut

Atlantic halibut is a large, cold-water, marine flatfish native to the Atlantic Ocean. Atlantic halibut can weigh up to 300 kg, though the general commercial weights are from 2.3 to 56 kg (Jia et al. 2006). It has a lean, mild, sweet taste, and is a valuable species that is harvested commercially in Atlantic Canada and is in high demand in global markets.

There are three stages in halibut aquaculture: hatchery, nursery, and on-growing; the hatchery includes brood stock holding and spawning, egg incubation, yolk sac larvae development, first feeding, metamorphosis and weaning (Forster 1999). These key technological hurdles caused increase risk and high costs of capital and production. Technology of halibut farming has improved significantly since research commenced in the early 1980s. Halibut grow out in sea cages is inconsistent in winter, and is easily affected by weather and temperature. Also, most aquaculture companies are small and private (Forster 1999). It is difficult for them to achieve economies of scale and afford high capital costs. Furthermore, the lack of economies of scale raise production costs at the early stages of halibut aquaculture; however, with expansion these costs should fall.

Initially, halibut broodstock were captured from wild stocks and "conditioned" in captivity for egg production, but now, cultured F1 broodstock are used. Considerable time must be invested in conditioning to ensure the production of high quality eggs. To achieve year-round hatchery production, spawning must occur outside the natural spawning season of halibut, which is February to May. This is accomplished through environmental manipulation to enable three spawning periods per year for continuous hatchery production.

Site requirements for halibut culture are similar to that of Atlantic salmon, making site locations difficult to obtain, as suitable areas are limited and most are already in use for salmon culture. The consequence of farming multiple species on a single site is largely unknown with respect to disease transmission and therefore not practiced. Limited inshore site availability is bringing offshore and land-based aquaculture options to the forefront, each presenting their own technical and economic hurdles.

Grow-out equipment required for halibut culture is different than that of Atlantic salmon. Halibut are bottom dwellers and require a flat surface to settle on. This greatly decreases the number of fish that can be stocked in a cage. Shelving units are frequently employed to increase the surface area and, subsequently, biomass. The benthic behavior

of halibut makes growout in cages more difficult and will require that changes be made to many of the successful grow techniques that have been developed by salmon farmers. Marine cage designs used in Norway for halibut culture have been studied by Canadian halibut growers but require further modifications to be optimized for conditions found in the Bay of Fundy.

Canadian Halibut Inc., an aquaculture company in St. George, New Brunswick plans to raise Atlantic halibut in sea cages. However, high start up costs, largely because of juvenile costs, creates financing problems; investors and government agencies want economic viability demonstrated before contributing funds. Clearly this demonstration cannot occur without production occurring first. This circularity suggests that one option is to wait until companies (in Europe) demonstrate viability. This option means that Canadian Halibut Inc. would give up the market temporarily, and move into the seafood market only later. The pros of this solution are that risks are reduced. However, the cons are very obvious. If a company gives up the seafood market temporarily, it would suffer the loss of early-mover advantage. Also, competitors would occupy the market share and it might not be easy for Canadian Halibut Inc. to get the shares back. Norwegian halibut producers are already targeting the US market; a relatively small Canadian producer would be squeezed.

The second option was to personally undertake research and technological innovation to demonstrate the economics associated with this industry. The pros of this alternative were that Canadian Halibut Inc. would manage the research direction, and obtain research results and innovation as business secrets. It might be a great competitive advantage for the company. Possibly the research results could be sold for revenues. On the other hand, Canadian Halibut Inc. would have had to face high costs and risks. The costs of independent research are high, and the results are full of uncertainty; they cannot be estimated in advance.

The last solution was to seek strategic partners and this was the approach adopted through collaboration with the Department of Fisheries and Oceans and the University of New Brunswick. Financial support was obtained from the Atlantic Canada Opportunities Agency (ACOA) and other agencies supporting research. It can be seen from Table 1 below that this was the optimal solution. Although the aquaculture technology is not yet mature, Canadian Halibut Inc. still has an opportunity to make profits from halibut sales. In the long term, it is reasonable to believe that the technology will be refined and that production costs will fall. This occurred with salmon farming.

Table 1. Strategies for developing halibut aquaculture

Strategies	**Financial Impact**	**Effectiveness & Efficiency**	**Organizational Impact**
Do nothing	Low	Low	Low
Do it by self	High	Moderate	High
Seek external partners	Moderate	High	Moderate

Juvenile production of halibut was regarded as the major "bottleneck" in the developing commercial aquaculture. The high upfront costs of obtaining juveniles, along with grow-out technologies that are yet to be optimized, are the major barriers to growth of halibut aquaculture as start-up costs are high and investors are hesitant to finance unproven practices. The high cost of halibut juveniles can be attributed to three factors: 1) they are smaller and more delicate in early life stages than most other fish species used for aquaculture, 2) their life stages are complex and include significant metamorphosis and 3) they have complicated feeding requirements at critical life stages, including nutrient requirements that can only be met using expensive life feeds. Live feed is used until fish have metamorphosed, at which time they are weaned onto inexpensive formula feeds that are easier to handle and produce. Halibut juveniles spend a longer time in the hatchery/nursery environment than do cod and haddock, making halibut considerably larger and more expensive when they are ready for transfer to sea cages. On a positive note, advances in hatchery production have increased survival rates, thereby lowering juvenile production costs.

Current status and research:

In Atlantic Canada, a single producer of juvenile halibut remains from an original group of three that started in the late 1990s. Maritime Mariculture Incorporated (1996) and R & R Finfish Incorporated (1995) have closed in recent years, leaving the production of juvenile Atlantic halibut to Scotian Halibut Limited in Clark's Harbour, Nova Scotia (1998). There is also one land-based commercial grow-out operation in Atlantic Canada. However, current production is on a much smaller scale than that of Atlantic salmon culture and what is predicted for the cod culture industry in the next few years. Atlantic halibut's production cycle has been well established and executed, but the high cost of stocking sites, in addition to the lack of proven grow-out equipment, has lowered investor confidence and this appears to be what is keeping production low.

Scotian Halibut.Ltd. has produced juvenile halibut for a study on various aspects of halibut growout for a 2005-08 production cycle. The multi-objective study will investigate issues related to optimal stocking size for juvenile transfer to sea cages, as well as monitoring health and productivity over the grow-out period. The study will also determine the impact of vaccines on growth and survival, along with issues relating to sexual maturation of the species in cage culture.

2.0. SEAFOOD MARKET OVERVIEW IN NORTH AMERICA

The capture fisheries continue to dominate total seafood production in North America. The capture fisheries account for 88% of total fisheries production in Canada and 98% in the US. Aquaculture's small role is due to the significant capture fisheries in both countries. The US has an aquaculture output almost four times that of Canada, but its capture fisheries are almost five times larger (Olin 2006).

More than 85% of Canada's fish and seafood is exported abroad to locations including the US as Canada's largest market, and also Japan, Taiwan and France. However, the capture fisheries appear to have peaked in tonnage. The US has a trade deficit in fisheries, with imports accounting for approximately 88% of US seafood consumption. To maintain per capita status quo, the US will require approximately one billion more pounds of seafood production by 2025 than the total supply in 2000. To meet this growing excess demand, the US Department of Commerce has set a target for US aquaculture production to reach US $5 billion by 2025 (from less than $1 billion in 2004).

The overall consumption of seafood in North America has followed the world-wide pattern with growing consumption. This is partly due to increases of per capita consumption, but also population growth. In the US, per capita fish consumption increased from 7.0 kg in 1999 to 7.4 kg in 2005. This increase occurred in spite of a rise in the real price of fish that exceeded that of other foodstuffs, particularly meat and grains. In Canada, apparent per capita consumption of fish products increased from 8.4kg in 1999 to 9.9 kg in 2003 (Table 2). Even with these increases, both countries consume relatively little fish; world per capita consumption exceeds 16.0 kg, and, without China, only 13.9 kg (FAO 2004)

Table 2. Apparent per capita consumption of fish products in kilograms (edible meat), 1999-2005.

	1999	2000	2001	2002	2003	2004	2005
US	7.0	6.9	6.7	7.1	7.4	7.5	7.4
Canada	8.4	10.0	9.5	9.8	9.9		

Source: NOAA, 2007; Statistics Canada, 2005.

2.1. FUTURE SEAFOOD DEMAND IN NORTH AMERICA

According to market projections, population growth and shifting demographics will create a strong demand for seafood in the United States over the next 20 yr (Johnson 2003). Even though per capita seafood consumption has been growing only slowly, it is expected that seafood will become the fast-growing sector in the US protein market.

Population growth in North America is expected to continue. Based on U.S Census Bureau estimates, the population of Canada will increase from 32.8 million in 2005 to 38.1 million by 2025, and that of the US from 295.7 million to 349.7 million (Olin 2006). Combined, the increase in population of the two countries will increase by 59.2 million (almost double that of the existing Canadian population). At current consumption levels of 7.5 kg per person, this increase alone will require an additional 445,000 MT of seafood (Olin 2006).

The population increase will be combined with shifting demographics. One variable that explains the increasing per capita consumption of food fish, and is expected to have an even more significant impact in the future, is the aging of the population in North America. The USDA has estimated an increase in per-capita consumption of seafood of 6.58% by 2020, which is largely driven by the age factor (Fig. 2). Older adults consume less beef and pork; this, coupled with the many positive health messages related to seafood consumption, is expected to generate growing demand for seafood. Consumer research has shown that older adults in the US eat more seafood than other age groups. For example, according to NPD Group, CREST, research on away-from-home dining, adults in the 50-64 age groups consume 35% more seafood than the national average, and adults over 65 eat 53% more seafood than the national average (Johnson 2003).

In Canada, it is projected that the senior population will increase by 2.7 million from 2001-21. In the US, as baby-boomers mature, 70 million Americans will pass the age of 60 by the year 2020. The total impact could be an increase in seafood demand of 0.5 billion kg edible weight, or about 1.81 billion kg round weight by the year 2020 (Fig. 3).

In addition to population growth and demography, there are other factors behind the demand for seafood, such as higher standards of living, tastes, health benefits, and the growth in tourism. All these factors affect not only the level of demand but also the nature and type of products consumed. Consumers are increasingly turning to fresh and ready-to-serve processed products, take-out and delivery, in addition to restaurants. The aging of the population will increase seafood consumption in restaurants as suggested by Table 3.

By 2020, it is estimated the top four species consumed – shrimp, salmon, tilapia, and catfish – will all come primarily from aquaculture. In addition, a variety of cultured fish will be offered interchangeably to satisfy white fish demand. On the product side, age-related opportunities may include functional seafood with added health and nutritional properties, such as vitamins and fish oil. It is also anticipated that this older demographic will demand smaller, more packaged portions, and be willing to pay more for upscale, value-added products.

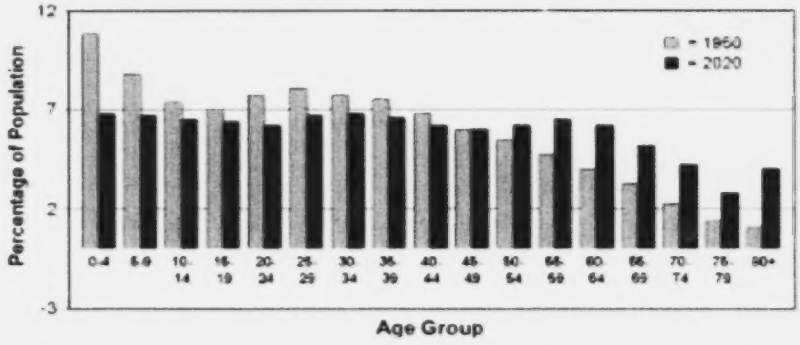

Fig. 2. Comparative age distribution of US population, 1950 and 2020 (projected). Source: Johnson 2002c, US Seafood Market in 2020.

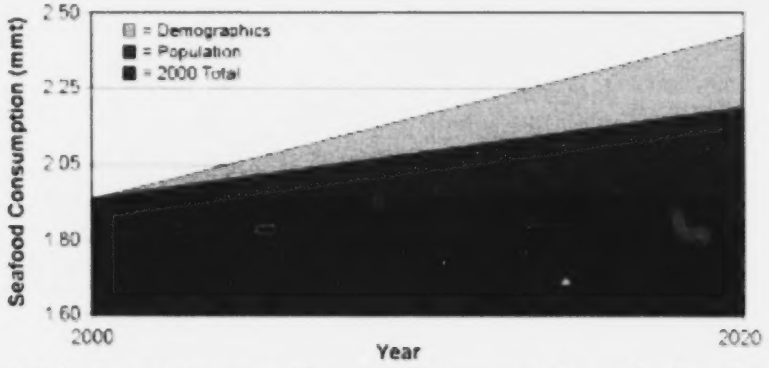

Fig. 3. Projected increased demographics, population, and demand of seafood in US, 2000-20. Source: Johnson 2002c, US Seafood Market in 2020.

Table 3. Seafood Consumption Index to Age in the US

	1998	2008	Change	Index to Casual Dining
Age	Population (000)	Population (000)	%	
Total	270.0	292.0	8%	
<10	39,141	38,922	-1	46
10-19	38,797	42,226	9	43
20-29	36,019	39,763	10	119
30-39	42,768	37,193	-13	118
40-49	40,624	42,929	6	127
50-59	28,108	39,124	39	138
60-69	19,833	26,050	315	129
70+	24,712	26,719	8	95

Source: Johnson, 2003.

3.0. MARKET OVERVIEW FOR ATLANTIC COD AND HADDOCK

3.1. ATLANTIC COD

Atlantic cod and haddock belong to the whitefish category, which dominates the value added seafood market. Whitefish consumption is growing from 2.4 to 2.6 kg per capita in the US (Fig. 4). However, the growth is in non-traditional species (Fig. 5).

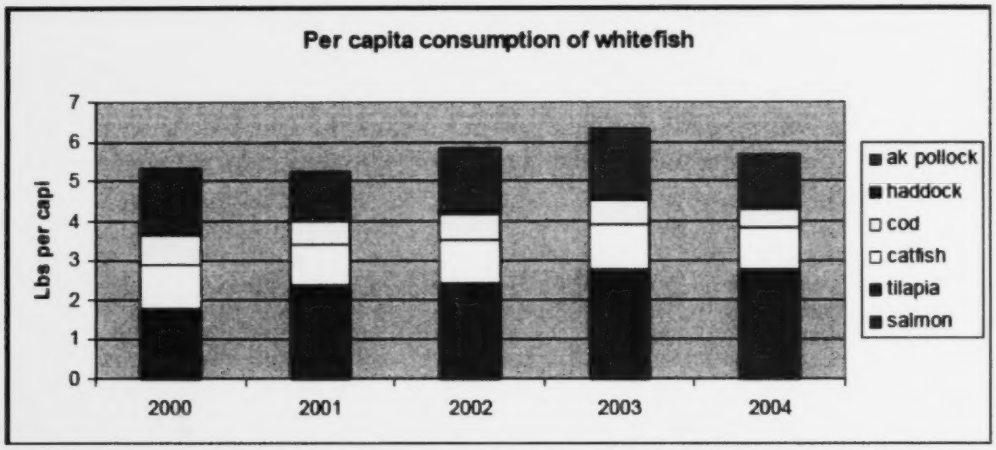

Fig. 4. Consumption of whitefish by species in the US 2000-2004 (lb per capita). Source: Sackton, 2006.

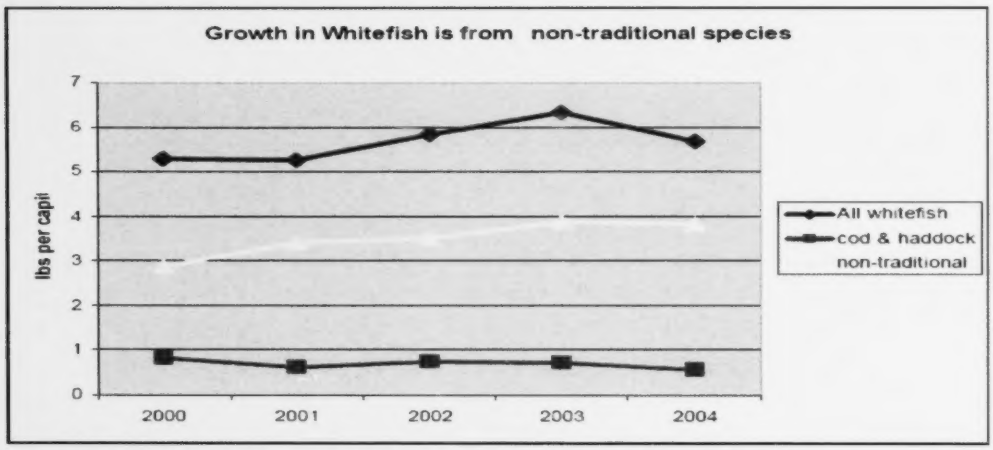

Fig. 5. Growth in total whitefish consumption 2000-04 (lb per capita). Source: Sackton, 2006.

During this period of dwindling cod fisheries and lack of supply, the market share of cod has gone to other fish species, predominantly from aquaculture sources. Table 4

illustrates how sharply cod production has fallen since the mid-1980s (more than halved), caused particularly by the decline in the capture fisheries from Canada. Canada used to account for a quarter of all cod capture, but by 2005, this share had fallen to 3% of a much smaller total. The table also illustrates the growing output of cod coming from aquaculture. The share of total production is still small at less than 1%, but Norwegian output has been expanding quickly.

Table 4 - World Production of Atlantic Cod 1985, 1990, 1995 and 2000-2005 (MT)

	1985	1990	1995	2000	2001	2002	2003	2004	2005
CAPTURE									
Canada	480,471	395,266	12,438	46,046	40,325	35,255	22,755	24,729	26,124
Iceland	322,810	333,348	202,900	238,324	240,002	213,417	206,290	227,222	212,423
Norway	246,363	124,235	365,333	219,197	208,977	228,094	216,890	230,731	225,894
Russia	145,990	78,260	297,770	170,878	188,630	187,865	185,982	204,937	203,733
Total Capture	1,963,379	1,490,817	1,270,501	940,351	944,859	903,211	849,002	899,636	842,951
AQUACULTURE									
Canada		90							
Iceland			33		140	192	380	636	636
Norway		555	284	169	864	1,258	2,185	3,165	7,410
Russia									7
UK					15			8	69
Total Aquaculture		645	317	169	1,019	1,450	2,568	3,809	8,122
Total Production	**1,963,379**	**1,491,462**	**1,270,818**	**940,520**	**945,878**	**904,661**	**851,570**	**903,445**	**851,073**

Source: FAO; Fish Stat Plus, FAO: Rome 2007a

It is anticipated that farmed cod will not be able to simply regain the once dominant market share of wild cod. From 1999 to 2000, the shortage of cod pushed prices up, and then prices fell down as consumers reacted to high prices and volatility. After 2003, the growth of Chinese processing demand pushed up raw material prices further, maintaining price levels. Cod prices affect the price of all other groundfish in New England and Canada, such as haddock and hake. Generally, cod prices can be used as a proxy to forecast other groundfish prices. Simply offering farmed cod as a replacement for wild cod may not be successful as prices will not be competitive to that fluctuation in wild cod catches and other substitutes.

All aquaculture strategic advantages must be fully utilized to make the marketing of farmed cod in Atlantic Canada successful. Efforts must be made to diversify the market of cultured cod from wild cod and secure a place in the minds of consumers so

that farmed cod is perceived as different and better.

The production of cod is bordering on commercial levels in Atlantic Canada, and is projected to grow rapidly within the next decade. Recently, Cooke Aquaculture Ltd., a large, locally owned company in Charlotte County, has announced that it has been successful in producing Atlantic cod. The company plans on harvesting approximately 100 MT in 2007. Atlantic cod and Newfoundland for centuries have been associated together for both cultural and economic reasons, and this will continue as Canadian cod farming has been centered in Newfoundland since the early 1990s. This is something that marketing efforts should capitalize on to promote farmed cod originating in Newfoundland. Therefore, Newfoundland has a strategic advantage as it has a strong market connection with Atlantic cod, which should be used in further marketing to distinguish Newfoundland's farmed cod from those captured from wild stocks. There is a growing public preference for sustainable products so, therefore, a farmed product has an advantage over fish harvested from seriously depleted wild stocks. However, the public also wants assurance that fish farming is conducted in an environmentally sustainable manner, and this applies to all species.

3.2. HADDOCK

Haddock is a highly priced traditional fish of eastern North America and has great market demand. The majority of consumption is relatively close to the point of landings and is marketed fresh, frozen, smoked (finnan haddie) and, to much lesser volumes, canned. Haddock flesh is mild flavored, and is a moderate- to firm-textured flesh. Overall haddock flesh is similar to Atlantic cod in both flavor and consistency. However the flesh is a bit softer and therefore does not salt as well. Haddock contains 0.2 g of omega-3-fatty-acids per 100-g serving, prepared by dry-heat.

The haddock fishery is a traditional fishery in Atlantic Canada and there are two major haddock fishing regions in the world, the Northeast Atlantic/Arctic and the Northwest Atlantic. The former has accounted for over 90% of the world haddock landings in recent years. World landings from 1950-2003 have ranged from a low of 190,000 MT in 1992 to a high of 960,000 MT in 1970, with an average of 427,000 MT. In 2003, landings of 275,200 MT were about 64% of the long-term average. Haddock fisheries landings in Atlantic Canada have been on the decrease. However, locally there has been a rally in catches off Newfoundland and Labrador. From 2001 to 2002, there was a 55% increase in landings, giving rise to a 78% increase in landed value. These trends are carried on in future projections of haddock landings in the US and Canada and have been projected to grow from approximately 26,000 MT in 2005 to 180,000 MT in 2006.

The production of haddock from aquaculture has not yet surpassed the experimental phase as can be seen in Table 5. Locally, haddock culture has been attempted with very little success and presently there are no documented production figures. The increases in the landings from capture fisheries, in combination with the lure of other potential aquaculture species such as Atlantic halibut and cod, has taken the focus of researchers and commercial producers away from the development of haddock culture.

Currently, haddock landings from the Northwest Atlantic are mainly sold in the New England states and Canada. In addition, landings from the Northeast Atlantic/Arctic are imported, making Canada and the US, collectively, a net importer of primary haddock products. Primary products include fresh or frozen, whole or dressed fish, fillets or blocks, as well as salted and dried haddock. Haddock is a traditional food fish to Atlantic Canada and the eastern US and this area makes up most of the haddock market. With an increase in haddock landings, it has been anticipated that haddock will continue to take over the market share of other whitefish species. Therefore, haddock landings need to be carefully examined, not only for the potential marketing of haddock aquaculture, but the marketing of all potential whitefish species coming from aquaculture.

Table 5. World production of haddock 1985, 1990, 1995 and 2000-05 (MT).

	1985	1990	1995	2000	2001	2002	2003	2004	2005
CAPTURE									
Canada	37,080	22,148	7,933	12,683	15,594	14,947	15,772	16,489	20421
Iceland	49,553	66,004	60,125	41,698	39,825	49,951	60,337	84,678	96,627
Norway	25,197	22,607	79,834	45,934	51,651	55,222	59,330	64,933	63,440
Total Capture	379,629	203,958	317,794	212,821	229,844	270,299	281,682	325,405	311,601
AQUACULTURE									
Iceland							63	72	72
Total Aquaculture							63	72	72
Total Production	**379,629**	**203,958**	**317,794**	**212,821**	**229,844**	**270,299**	**281,745**	**325,477**	**311,673**

Source: FAO; Fish Stat Plus, FAO: Rome 2007a

Since 1994, Canada imports as much as it exports of primary haddock products. Most imports are frozen fillets and, to a lesser extent, frozen whole fish. Exports are mainly fresh whole dressed fish. In 2003, Canada imported the equivalent of about 18,100 MT of haddock in round weight, while it exported the equivalent of about 12,500 MT. The Canadian consumption of primary haddock products in 2003 was estimated to be about 21,300 MT, in which landings were 15,700 MT and net import was 5,600 MT.

Canada imports mainly from the United Kingdom, Norway, Russia and China. Since 2000, China has become a major player in imports of processed haddock products to Canada. It accounted for 14% of the haddock import value, and by 2003, the percentage had risen to 60%. These fish are predominantly imported in a frozen fillet form. Almost all of Canada's haddock exports are to the US.

The US is a net importer of primary haddock products, and exports very little. Total imports in 2003 were about $94.1 million USD, of which $24.6 million USD were from Canada. Imports consist of fresh and frozen fillets, and also fresh and frozen whole fish. The US imports about 52,000 MT of round fish, while exports are negligible. US landings were 6,800 MT and the net import was 52,000 MT in 2003. The US imports are mainly from Iceland, Canada and Norway. Canada supplies mostly fresh whole fish, while Iceland supplies mainly fresh and frozen fillets (Fig. 6).

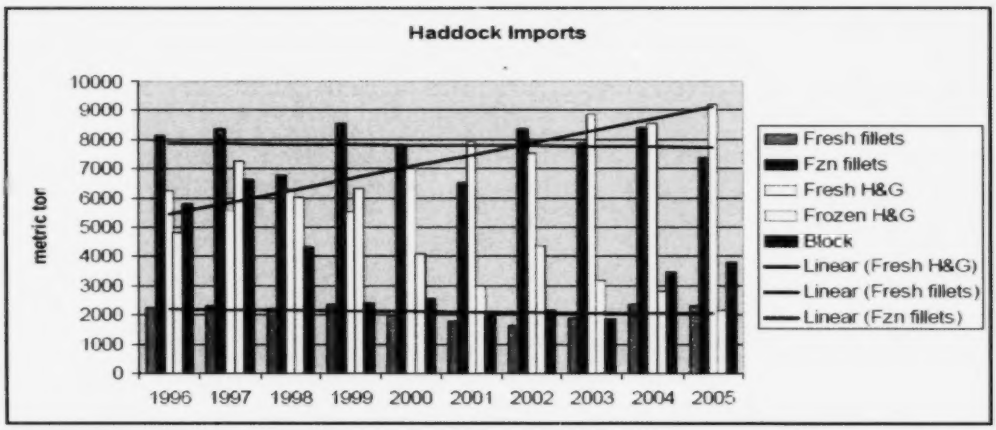

Fig. 6. Haddock import details (MT). Source: NOAA, 2006.

The principal product form of haddock is fresh, which is different from cod or Alaska pollock as shown in Fig. 7. Unlike these two species also, haddock is not salted. Filleted, and head and gutted (H&G) are two other product forms of haddock. Given the growing market preference for fresh fish and for fillets this suggests that the market for haddock will remain strong. According to Fig. 8, fresh haddock tends to have lower prices in summer due to higher supply and frozen cod fillets, loins, and portions can command a higher price.

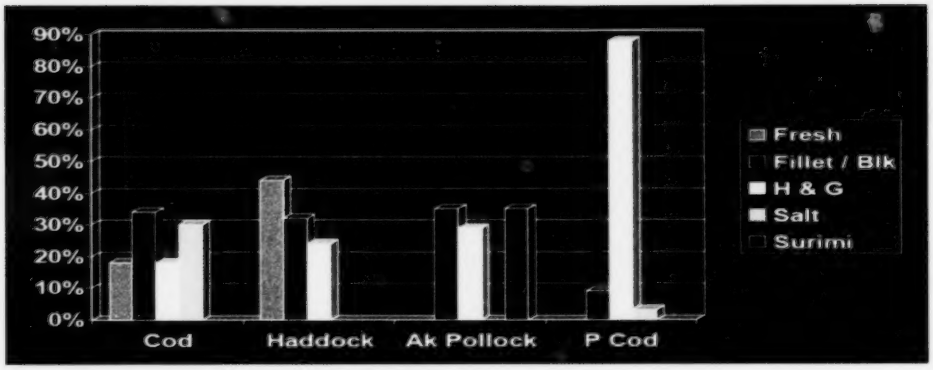

Fig. 7. Product forms 2004 (%)
Source: Sackton, 2006.

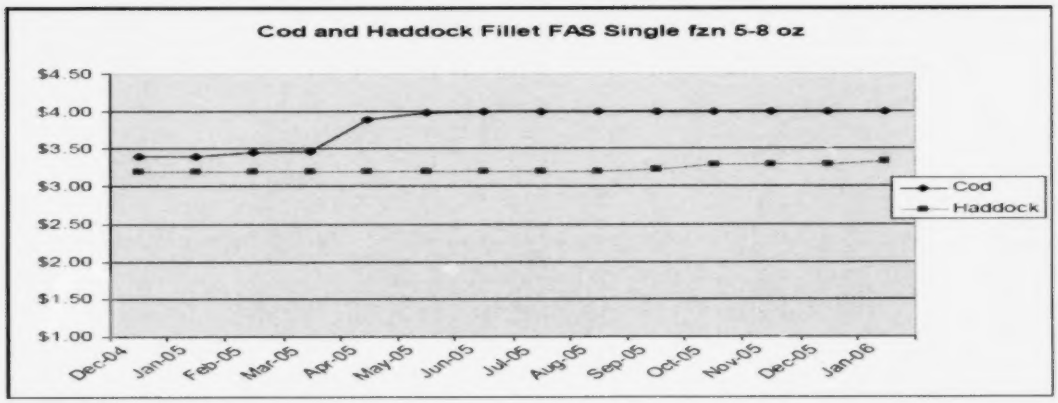

Fig. 8. Seasonal prices of haddock (US$)
Source: Barry, 2006.

In conclusion, haddock is well known in eastern Canada and US markets as it has been fished there for centuries. The advantages are as follows:

1. Strong regional consumption base in northeast, particularly in New York and New England.
2. Mild whitefish flavor file; does not challenge the American consumer's idea of taste.

However, it is competing in a competitive whitefish market with lots of substitutes, including, but not limited to halibut, cod, tilapia and catfish, all selling at different price points. Haddock will have to use a combination of its consumer familiarity and flesh quality attributes to remain competitive. Fresh market for haddock, especially whole fish from Canada, shows strong growth.

Strategy:

1. Reposition haddock as "new" whitefish species.
2. Need to penetrate value added market
3. Expand beyond traditional market: fresh need to become national market

4.0. MARKET OVERVIEW FOR HALIBUT

In Canada, aquaculture is largely dominated by Atlantic salmon farming, but other species offer real opportunities for diversification, including Atlantic halibut, which is recognized as the largest marine flatfish in the world, and can weigh up to 300 kg. Atlantic halibut ranges through the deeper waters of the western Atlantic from Labrador to the Gulf of Maine, seldom entering waters of less than 60 m deep. General commercial weights from capture fisheries are from 2.3 to 56 kg. Halibut is a premium marine species and is marketed fresh and frozen in steaks and fillets. Halibut flesh has a content of omega-3-fatty acids at 0.4 g per 100-g portion, cooked using dry-heat, higher than that of haddock and cod. It has a pure white, firm, mild-tasting flesh, with good shelf life and without pin bones.

4.1. PRODUCTION OF HALIBUT

4.1.1. Atlantic halibut (*Hippoglossus hippoglossus* L.)

Total production (capture and aquaculture) of Atlantic halibut has declined since the 1970s but this decline has stabilized (even reversed) since 2000. Canada is the largest producer accounting for approximately a quarter of the total with landings, consistently around 1500 MT over the last decade (Table 6). Most landings were caught off Nova Scotia. However, Canada's share of production has fallen from about a third in 1985. This is due to declining landings in Canada and increases in some European countries such as Norway. In addition, aquaculture output of halibut is increasing in Europe (Norway and the UK) and, by 2005, accounted for almost one-quarter of total production.

Considered a nuisance species in the Gulf of Maine during colonial times, halibut was not targeted commercially until the early nineteenth century (Collette and Klein-MacPhee 2002). However, by the 1940s the stock had collapsed and was considered "commercially extinct" with annual landings averaging less than 100 MT after 1953. A targeted fishery did not occur in the Gulf of Maine between the mid and late twentieth century, resulting in a severe lack of data. Atlantic halibut catches in federally regulated US waters currently are limited to bycatch levels (one fish per trip) incidental to the targeted groundfish fishery.

Table 6. World production of Atlantic halibut; 1985, 1990, 1995 and 2000-05 (MT)

	1985	1990	1995	2000	2001	2002	2003	2004	2005
CAPTURE									
Canada	3,936	2,415	895	1,219	1,647	1,649	1,829	1,850	1,746
Iceland	1,691	1,647	888	493	589	683	634	574	524
Norway	615	419	551	1,039	869	676	794	1,033	1,076
UK	123	132	405	208	159	222	296	251	290
Total Capture	8,145	6,948	3,717	3,576	4,409	4,082	4,542	4,616	4,488
AQUACULTURE									
Iceland				34	93	120	95	-	-
Norway				-	-	424	427	631	1,173
UK				1	80	187	187	187	272
Total Aquaculture				35	173	731	709	818	1,445
TOTAL PRODUCTION	**8,145**	**6,948**	**3,717**	**3,611**	**4,582**	**4,813**	**5,251**	**5,434**	**5,893**

Source: FAO; Fish Stat Plus, FAO: Rome 2007a

The vast majority of Canadian halibut species is sold directly to the United States. Atlantic halibut is predominately offered fresh in steaks and fillets and has been demonstrated to demand a higher market price than any other halibut species. Demand for Atlantic halibut is considered latent due to the low volume of landings. The market for Atlantic halibut is typically close to the point of capture and very little marketing effort is required to promote the product. The small volumes of Atlantic halibut landings make supply very sporadic, thereby not allowing for value-added production facilities or the continuation of marketing efforts.

Based on data from NOAA, Fig. 9 indicates the relatively high price of Atlantic halibut (NOAA Fisheries Office of Science and Technology 2006). Fluctuating around the US $24/kg range the price of halibut is much higher than its substitutes – Atlantic cod, sole, haddock, and meat. Atlantic halibut is considered a high value fish. So the potential segments that purchase halibut would be from the high income population. On the other hand, due to the fact that halibut contains various nutritional benefits such as potassium,

selenium, vitamin B6, vitamin B12 and omega 3 fatty acids, consumers may be attracted to halibut due to health advantages. From the same charts, the price of sole, cod, and haddock are very similar resulting in an increase in competition among those fish markets. But because of the high price of halibut, it is definitely to the industries' advantage to differentiate halibut from sole, cod and haddock.

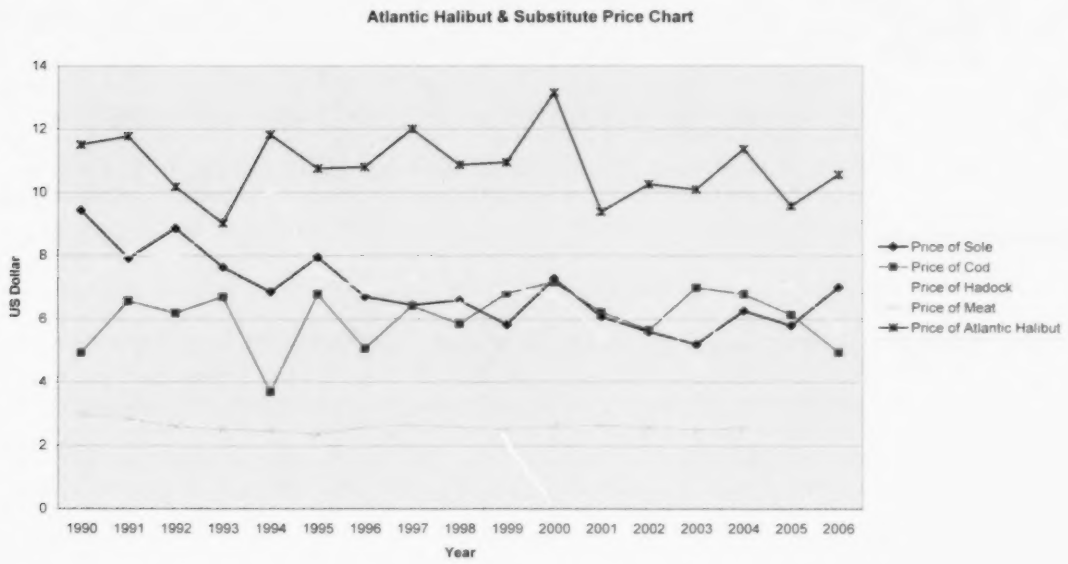

Fig. 9. Price of Atlantic halibut and substitutes in the US (US $ per lb).
Source: NOAA 2006.

Figures 10 and 11 have almost identical shapes. They only include the quantity of halibut that the US imported from Canada. From both charts we observe that the quantity of demand for halibut increased from 1998 to 2001 but since 2001 there is a downward trend in halibut sales. If supply is not limiting, this may indicate less demand and may cause the market to shrink. However, more likely the downward trend of halibut sales may be caused by the lack of supply. This assumption is plausible given the decline in production of Atlantic halibut since 1990 (Table 6) and falling per capita availability. Aquaculture has not yet offset the declines in the capture fisheries.

Having a consistent year round supply of fresh Atlantic halibut from aquaculture will enable the development of new markets such as catering and restaurant markets. These markets are viewed as some of the most lucrative for fresh halibut. However, these markets require consistent quality and supply at a stable price that can stay in the price margins set by these industries. Presently in Atlantic Canada, it is the price that is keeping Atlantic halibut off restaurant menus. Restaurants in Atlantic Canada attempt to keep

up-scale halibut dishes between $16-18, which is not feasible at the current price of fresh Atlantic halibut (Billy's Seafood Company, Saint John Market, pers. comm). This is a potential problem as farmers have high costs of production and risks. However, consumers are expecting the price of fresh Atlantic halibut to drop as aquaculture removes the scarcity pricing affects. As well, the potential for branding and value-added products of this premium species will be important to the development of the retail market.

While some of the production of farmed Atlantic halibut in Europe will be for consumption in Europe, Norwegian producers are targeting the US as well. A significant competitive advantage of Canadian producers is transport. To the US, whole fresh salmon from Norway has a transport cost of US$1.30 per kg, compared to Canadian transport costs of US$0.20 per kg (Agriculture and Agri-food Canada 2006)

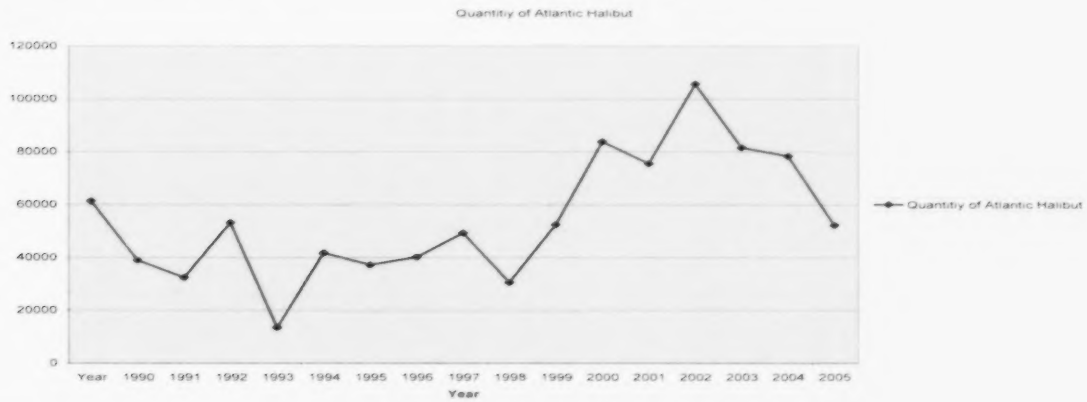

Fig.10. Quantity of Atlantic halibut (kg) imported into the US.
Source: NOAA, 2006

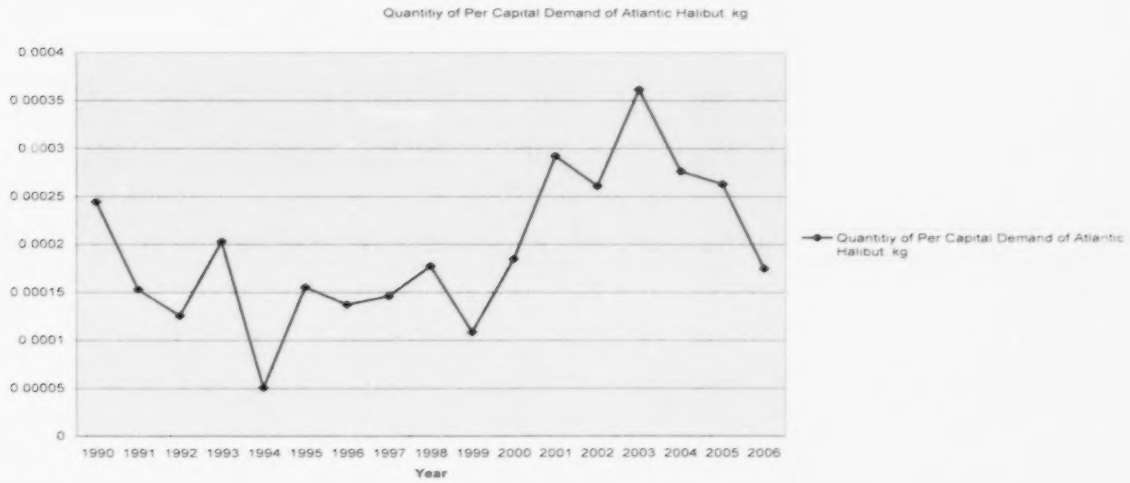

Fig. 11. US per capita demand for Atlantic halibut (kg). Source: NOAA, 2006.

4.1.2. Pacific Halibut (*Hippoglossus stenolepsis*)

Pacific halibut is found in the northern Pacific Ocean, from California to the Bering Strait, and south to Japan. The Canadian capture fishery on the west coast for Pacific halibut is at approximately 6000 MT. Until 1979, Canadian and US fishers caught Pacific halibut in the water of both countries. The implementation of Exclusive Economic Zones (EEZ) from 1979 to 1981 prevented Canadian fishers from fishing in US waters, where the majority of the stock is found. Therefore, the production in the US has been much more than that of in Canada (Table 7).

Table 7. World production of Pacific halibut; 1985, 1990, 1995 and 2000-05 (MT)

	1985	1990	1995	2000	2001	2002	2003	2004	2005
CAPTURE									
Canada	6,255	5,031	5,745	6,095	4,766	6,487	7,139	7,395	7,497
US	27,594	31,942	20,551	34,753	35,391	37,237	36,051	35,909	34,890
TOTAL PRODUCTION	**33,849**	**36,973**	**26,299**	**40,848**	**40,161**	**43,724**	**43,190**	**43,304**	**42,387**

Source: FAO; Fish Stat Plus, FAO: Rome 2007a

The capture fishery of Pacific halibut is considerably more than its Atlantic counterpart. However, the lucrative fresh market of Atlantic halibut will not be troubled by the capture fisheries on the west coast, as price for fresh Pacific halibut is generally much the same as Atlantic halibut by the time it has reached the east coast, due to transportation costs. As well, Pacific halibut does not have the prestige of the Atlantic halibut even though they are very similar. An interesting marketing occurrence on the west coast has seen Pacific halibut captured by Canadian vessels successfully sell for higher prices than American-caught Pacific halibut. This is an occurrence that has been noticed since the development of the individual vessel quota system was implemented in 1991. There appears to be an intrinsic value for Canadian fish products in the US market place. This is a consumer perception that should be capitalized upon and hopefully can be utilized on the marketing of all Canadian aquaculture species.

The Canadian fleet has been restricted to British Columbia waters; combining this outcome with increased landings in Alaska has resulted in an increased Canadian dependence on imports of Pacific halibut from the US since 1981.

The Individual Vessel Quota system was implemented in 1991, which permits BC fishers to land Pacific halibut over an 8-mo season from March through October, instead of three or four major 1-d openings; this has allowed more Pacific halibut to be landed fresh. During this time, most US-caught halibut were frozen and BC firms did very well by exporting much of their fresh halibut to the US. The result was a three-fold increase in the quantity and a four-fold increase in the value of exports from Canada to the US between 1990 and 2000. However, the Individual Fishing Quota system implemented in 1995 in Alaska caused Canadian imports of Pacific halibut to more than double over a 5-yr period, as the US could now supply fresh halibut for a longer season as well. Since 1998, the quantity of Canadian Pacific halibut exported has surpassed the weight of halibut landed, with the difference presumably being made up by imports, which are processed to some extent and than re-exported.

4.1.3. Greenland Halibut (*Reinhardtius hippoglossoides*)

Greenland halibut is marketed in the US as "Greenland turbot". It can be found in the cold Arctic waters and deep bays around Newfoundland, Labrador, Baffin Island, and the Gulf of St. Lawrence. Long distances between harvesting areas and processing plants frequently require Greenland halibut to be frozen at sea. Plants in Nova Scotia and Newfoundland do most of the processing. The fishery extends from April to November, but mainly takes place in summer.

US landings fluctuated between 14 MT and 8219 MT between 1998-2003, while landings in Canada were maintained at more than 11,000 MT during the same period (Table 8). Even though Norway and Iceland also produced approximately the same quantity of Greenland halibut as Canada, Canada has been the main import origin in the US market because of the neighborhood relationship.

Table 8. World production of Greenland halibut; 1985, 1990, 1995 and 2000-05 (MT)

	1985	1990	1995	2000	2001	2002	2003	2004	2005
CAPTURE Canada	17,710	19,602	8,775	16,444	13,814	11,237	15,294	14,682	15,618
Iceland	29,231	36,557	27408	14,553	16,642	19,229	20,366	15,486	13,030
Norway	5,480	17,323	11,695	11,591	13,694	9,390	9,745	15,586	14,239
Russian Fed	10,237	6,688	1,483	8,879	9,568	10,209	9,128	8,059	8,828
US	-	10,159	5,860	6,186	4,391	2,937	2,558	1,879	2,368
TOTAL PRODUCTION	**86,233**	**131,988**	**100,279**	**113,898**	**113,012**	**110,812**	**122,467**	**112,825**	**105,019**

Source: FAO; Fish Stat Plus, FAO: Rome 2007a

4.2. SWOT ANALYSIS OF FARMED ATLANTIC HALIBUT

4.2.1 Strengths

There is a trend that aquaculture has become more and more important for seafood market. It is predicted that aquaculture may dominate worldwide fish and seafood production by the year 2030 (http://www.acoa.ca). Also, according to the study conducted by the Economic Research Service of the United States Department of Agriculture (USDA) in February 2000, the demand for seafood will keep increasing in the US over the next 20 yr because of population growth. In the long run, "halibut stands out as having some of the best potential for the production of mass market, further processed products" (Forster 1999). Moreover, the halibut has a very good immune system. Therefore, there are few disease problems in the growth of halibut, and the expected survival rate can be 80% or more (Forster 1999). Furthermore, halibut grows quickly. According to Forster (1999), it can reach 4.5-5.4 kg in 12-24 mo at optimal temperatures. Under good management, the growth rate of halibut will be faster and faster.

Most Atlantic halibut is sold directly to the United States. The main market is close to production and capture location; therefore, Atlantic halibut can keep fresh. It is a great advantage of Atlantic halibut, and can be used to explain why its price is higher than other halibut products. According to current trends, more and more producers will come to join halibut farming, and halibut production could keep increasing.

4.2.2. Weaknesses

Atlantic halibut has very limited volume for sales because landing is the biggest source of halibut supply. Low volume always causes high price which can reduce the quantity demand of halibut. The worldwide Atlantic halibut landing was just 3643 MT in 2003, and Canada produced 1829 MT, which was almost 50% of total production amount (Jia et al. 2006); it is also reasonable to believe that in the next few years, halibut landings will continue to dominate the halibut supply.

Also, the production costs of Atlantic halibut aquaculture are very high. Using current technology, it is a big challenge for producers to recover high costs. High production costs are mainly attributed to capital requirement and high costs in the early stages of halibut aquaculture. Therefore, some reasons can be cited to explain capital requirements and high costs in the juvenile stage: 1) halibut is smaller and more delicate in early life stages than most other fish species; 2) its life stages include significant metamorphosis; 3) halibut has complicated feeding requirements (Jia et al. 2006). Although more and more people have been showing their interest in halibut aquaculture, halibut farming is still too small, and cannot achieve economies of scale. It will be a critical problem for small aquaculture companies to reduce production costs.

Moreover, Atlantic halibut production is vulnerable and inconsistent because weather and temperature have an impact on sea cage production of this species. According to Forster (1999), halibut do not grow if the seawater temperature is low. Limekiln Bay outside of St. George, New Brunswick, the location of the existing halibut grow-out site, has a very long winter. Low temperature of seawater will last for 4-5 mo in each year. Therefore, in those months, the halibut production should slow significantly until the weather turns warm. Also, winter superchill could hurt halibut production during severe winter conditions. This is another important reason why the costs and selling prices are so high. On the contrary, in summer, which is harvest season, the prices decrease due to high supply.

4.2.3. Opportunities

Market prices for Atlantic halibut are higher than those of salmon (Jia et al. 2006). These higher prices provide motivation to the aquaculture companies to shift from salmon to halibut farming.

Other halibut species, such as the European halibut, are very difficult to sell to North Americans. Even if other halibut species were sent to the US, the fish would be frozen, and the transportation costs are almost 20% (Jia et al. 2006). Most customers

prefer fresh Atlantic halibut at lower prices. Therefore, the North American halibut market is being dominated by Atlantic halibut, which is in higher demand than other species.

Aquaculture of halibut is a new developing business in Atlantic Canada. The Canadian government supports private companies to develop halibut aquaculture and funds research on halibut aquaculture. For example, the Department of Fisheries and Oceans' (DFO) Biological Station at St. Andrews, NB, provided fish eggs for commercial production (Forster 1999).

In the current market, the most popular seafood is salmon. In Atlantic Canada, the total amount of aquaculture production was 64,000 MT in 2004, and Atlantic salmon accounted for 55% of this volume (Jia et al. 2006). Therefore, the customers' demand for diversity provides good opportunities for halibut sales.

4.2.4. Threats

The main threat that halibut aquaculture has to face is competition. In the market, Atlantic halibut has to compete with other lower-priced species, such as cod, haddock and tilapia, and to confront the competition from other halibut species. In addition, Norwegian farmed halibut will be on the US market. With its lead, Norway may be able to lower production costs through technological advances and economies of scale, thereby offsetting higher transport costs.

4.3. INCOME AND PRICE ELASTICITY OF DEMAND

The objective of this section is to identify the factors that affect the demand for Atlantic halibut, and then provide a reliable source of information to explore the market potential for farmed Atlantic halibut in Canada. There is no doubt that there must be a variety of factors that could affect people's demand for a certain product other than social economic factors, such as culture, diet habit, etc. However, this study will be mainly focused on the economic factors, which means it will examine how income and price elasticity could affect the market demand for Atlantic halibut.

4.3.1. Model

Considering the objective of this study, we assume the demand function for Atlantic halibut is:

$$q = B_0 * p^{B1} * p_{sf}^{B2} * p_{meat}^{B3} * I^{B4} \qquad (1)$$

where,

q : per capita consumption of fresh Atlantic halibut;

p : price of Atlantic halibut;

p_{sf} : price of substitute of fishery products;

p_{meat} : price of substitute of meat products;

I : per capita annual disposable income.

Based on this assumed demand function, the regression model is the transformed form of the equation above:

$$\ln q = B_0 + B_1 \ln p + B_2 \ln p_{sf} + B_3 \ln p_{meat} + B_4 \ln I \quad (2)$$

In this transformed equation, the parameter B_1 stands for price elasticity, B_2 stands for cross elasticity between cod and halibut, B_3 stands for cross elasticity between meat and halibut, and B_4 stands for the income elasticity of halibut. Since there is a problem of scarcity of data, the data used in this report comes from historical data based on America's imported Atlantic halibut and other fishery products from the years 1990 to 2004. Although we do not have the accessibility to data for domestic American or Canadian market price and demanded quantity of halibut, it is reasonable to believe that the information of the trade of these products between Canada and America should be able to reflect some of the relationships between those variables. Based on economic theories, we expect the results as following:

$B_1 = \dfrac{\partial \ln q}{\partial \ln p} < 0$, meaning higher price of halibut leads to lower demand of halibut;

$B_2 = \dfrac{\partial \ln q}{\partial \ln p_{sf}} > 0$, meaning the increase in the price of other fishery products, which mainly refers to cod products here, causes an increase in demand for halibut;

$B_3 = \dfrac{\partial \ln q}{\partial \ln p_{meat}} > 0$, meaning that meat products are other good substitutes for halibut;

$B_4 = \dfrac{\partial \ln q}{\partial \ln I} > 0$, meaning the increase in per capita disposable income leads to an increase in demand for halibut.

Because the data we used are historical time series data, before using the method of ordinary least square to run the regression model (2), we station these time series data to assure the obtained results are reliable. The results are presented in the next section.

4.3.2. Data and Estimation Results

The model uses data from the US and therefore estimates coefficients of US demand. Fish prices come from NOAA, and are based on the quantity and value (in US$) of imports of different fish species into the US (NOAA Fisheries Office of Science and Technology 2006). Data on meat prices come from the USDA Economic Research Services, and on incomes from the US Bureau of Economic Analysis (2006).

Three versions of equation (2) have been estimated using cod, sole, and haddock as the representing seafood substitutes for halibut in the three versions of equation (2). All nominal variables have been deflated with the year 2000 as the base year, and the results are reported in Table 9 and Table 10.

Table 9. Regression results of the model.

Version	Dependant Variables	Intercept(B_0)	p (B_1)	p_{sf} (B_2)	p_{meat} (B_3)	I (B_4)	Radj 2	DW
1(sf=cod)	$\ln q$	-39.064 (-4.25) ***	-2.118 (-2.74) ***	.944 (2.10) **	4.534 (3.32) ***	2.928 (3.26) ***	.69	2.07
2(sf=sole)	$\ln q$	-64.682 (-4.19) ***	-2.557 (-3.11) ***	1.380 (1.70)	3.789 (2.50) ***	5.551 (3.86) ***	.65	2.76
3(sf=haddock)	$\ln q$	-29.016 (-1.86) *	-1.889 (-2.04) **	-.847 (-1.24)	3.728 (2.23) ***	3.28 (2.24) ***	.61	2.97

Table 10. Estimated elasticity

Equation Number	Price Elasticity	Income Elasticity	Cross Elasticity (meat)
1	-2.118	2.928	4.534
2	-2.557	5.551	3.789
3	-1.889	3.28	3.728

As shown above, when different fishery products presenting substitutes for halibut are used, the results are slightly different. However, all the estimated results are consistent with theoretical expectations. Income elasticity is always significant at the 99% level, and ranges from 2.928 to 3.280. The income elasticity is reasonably high and these results support the fact that fresh halibut is a strongly superior product.

The significant results for own-price elasticity of halibut show that demand for halibut is price elastic, ranging from -1.9 to -2.6. This is high, but conforms to other

species modeled, particularly when data are not derived directly from retail prices (Asche et al. 2005). The high price elasticity means suggests that halibut could be farmed economically because increased supplies will not adversely affect farm incomes. It should be noted that, as farm production increases and there is a movement down the demand curve, own-price elasticity will become less elastic.

Considering other fishery products as the fishery type substitute for halibut, results show that only cod is a significant substitute for halibut. Even so, the cross-elasticity between cod and halibut is only 0.9, not really high. On the other hand, meat appears as a more significant substitute, with a cross-elasticity between meat products and halibut ranging from 3.7 to 4.5. This result contradicts cross-elasticity estimates for other species and may be due to the high price and luxury image of Atlantic halibut (Asche et al. 2005).

4.3.3. Conclusions

The elasticity results have important implications for marketing Atlantic halibut. The average income elasticity of demand for fresh Atlantic halibut is about 3.92. This suggests that 1% increase in per capita annual disposable income will lead to about 3.92% increase in per capita demand for Atlantic halibut. If American annual per capita disposable income increases at a rate of 2% per year, the per capita demand for Atlantic halibut would increase 7.84% a year. Based on results from the three equations, the price elasticity of halibut is about –2.2, and this means a 1% drop in the price of halibut will bring about a 2.2% increase in per capita halibut demand to the market.

The price of meat products has a significant influence on the market demand for halibut. The results indicate that a 1% increase in price of meat products would cause about 4.0% increase in per capita demand for halibut. Therefore, one substitute for halibut, meat price, affects the demand for halibut more substantially than other fishery products.

All the findings from this study identify the significantly influential factors that affect the per capita demand in Atlantic halibut, and these should be incorporated into the marketing plan of Atlantic halibut.

5.0. MARKETING CHANNELS FOR FARMED HALIBUT

Elasticity estimates indicate that farmed Atlantic halibut has very good opportunities in the current market if technological and initial start-up capital challenges can be overcome. Norway and other European countries are expanding their farmed output although it still remains small. Therefore, it would be wise to enter the seafood market as soon as possible.

The primary objectives of this section are to analyze comprehensive market information from consumers, retail groceries and restaurants; to assess the effectiveness of advertising and promotion of farmed Atlantic halibut; and to develop an overall assessment of potential for marketing Atlantic halibut in North America, Middle East and Asia.

5.1. NORTH AMERICA

North America is the major market for halibut. Consumer demand for wild Pacific halibut, farmed Pacific halibut and cultured Atlantic halibut will probably be similar. Halibut is a desirable fish for which consumers are willing to pay a high price. The attributes favored by consumers include: white meat, firm texture, mild flavor, few bones, good shelf life, and ability to be frozen without loss of flavor or texture. Restaurant and retail consumers both value halibut.

Atlantic halibut also has several desirable attributes from a processing and distribution point of view. Its large size facilitates cost-effective handling and processing. A 10-kg halibut is considered to be a good size for steak by restaurants and retail stores. Halibut also has a very good fillet yield of up to 60%, compared to only 30% for rockfish, sole and cod.

5.1.1. The United States

Canada, especially eastern Canada, is the main source of US imports of low value-added fresh and frozen products. Recently, high-end, value-added products are shipped to consumer markets in New York and Boston. Canadian halibut exporters have a substantial advantage in the US due to geographic proximity, language, low or non-existent tariffs, and historical tradition. Size preference for halibut varies by region within the US. The West Coast buyer prefers fish over 18kg dressed head-off while the East Coast buyer prefers smaller fish in the 4.5-9.0 kg range, and the US Mid-West buyer prefers a size range in between. Farmed Atlantic halibut of 3-7 kg is presently sold in the eastern US. Potential buyers of live fish would want fish under 9 kg.

Mid-Atlantic region:

Fish and seafood customers in the mid-Atlantic region are mainly retailers and food service establishments. Local mid-Atlantic seafood wholesalers supply approximately 90% of these customers. Retailers account for 20% of the seafood market, while food service accounts for approximately 80%. Many mid-Atlantic wholesalers and distributors purchase fish and seafood products from Canadian suppliers and producers, either directly or through brokers in New England. Canadian suppliers should be aware that larger distributors and wholesalers are more likely to take on new market entrants.

Canadian suppliers looking to sell to the mid-Atlantic market may want to consider approaching large retail supermarket chains, because under certain conditions that support purchasing efficiencies, they will consider buying directly from suppliers.

The mid-Atlantic food retail market is dominated by supermarket and club chains, but also includes independent stores and a growing number of organic and health food chains, and independent retailers such as Whole Foods, Trader Joe's and My Organic Market. Major supermarket retailers in the mid-Atlantic are Safeway, Shoppers/Metro, Giant Food, Acme Markets, and Ukrop's. The growing concern over fish welfare, environmental standards and traceability in the US is part of negotiations in purchasing contracts.

The food service industry includes hotels, restaurants, and institutions that serve fish and seafood for convenience to its staff and/or to customers. Institutions include hospitals, schools, nursing homes, and museums.

North Central region:

Seafood is universally popular in the north central region (NCR). Restaurants are a primary market for aquaculture products, since 67% of consumers' seafood dollars are spent in food service outlets. In the NCR of the US, almost two-thirds of restaurants are located in small towns or rural population centers of fewer than 100,000 people. Only 10% are located in major urban centers. However, these restaurants typically purchase frozen rather than fresh seafood products. Frozen seafood products typically account for 80% of NCR restaurants' seafood purchases.

Restaurants in the NCR typically prefer weekly deliveries of seafood, even when purchasing frozen products. While NCR restaurants sell seafood year round, customer demand in restaurants for seafood also tends to be cyclical, that is, customer interest is highest in the summer months, next highest in the spring, and relatively low during the fall and winter. Farmers must prepare for price cycles. In the NCR, food service distributors are the largest source of seafood for restaurants, followed by seafood wholesalers and grocery wholesalers.

To be successful in NCR, which is a price-conscious market, Canadian halibut suppliers must be able to:

1. Deliver within 24-48 h,
2. Ensure consistent year-round supply,
3. Offer attractive pricing.

Value-added seafood, including pre-seasoned and pre-prepared chilled, cooked and fresh halibut, have a good potential market. The most recent trend is an increase in

fish and seafood consumption by college-aged consumers who are eating healthier food in order to do better in school.

East region:

In the eastern US market, Atlantic halibut competes with Pacific halibut and a variety of other white-fleshed fish including cod, haddock, and flounders. East Coast consumers historically have had access to, and are used to consuming, a variety of white-fleshed seafood.

Seventy-five per cent of East Coast restaurants prefer purchasing fresh seafood. Buyers and marketers report that fresh Atlantic halibut, mostly farmed, reaps a $6-$8 per kg dressed head-off price premium in the northeast US when the commercial fishery for Pacific halibut is closed (November to March) and only frozen Pacific halibut is available. Figure 9 illustrates the seasonal demand for Atlantic halibut, determined in part by the availability of fresh Pacific halibut.

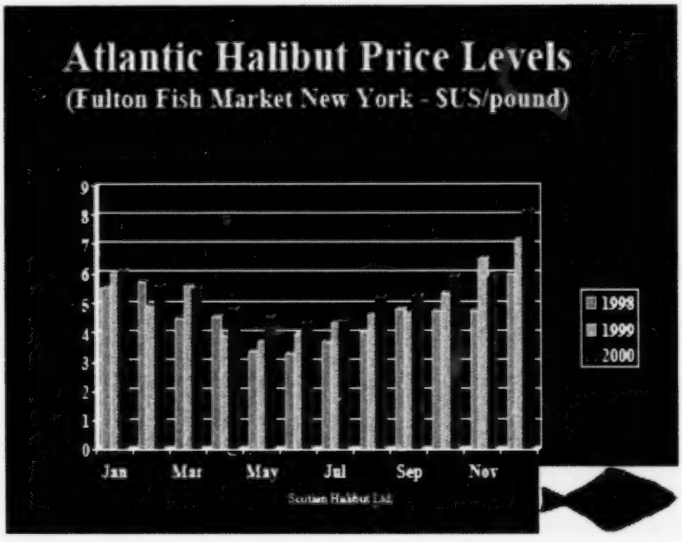

Fig. 12. Seasonal price variations of Atlantic halibut in New York (US$/lb)
Source: Swim, 2003

When both fresh Atlantic and Pacific halibut are available, Atlantic halibut still commands a price premium, even though much reduced (about 10-15% price premium). Buyers will typically quote prices for one species when negotiating purchases for the other species.

The price premium for Atlantic halibut is based on two factors: tradition and perceived quality. Atlantic halibut is a traditional seafood product in the eastern US. The Atlantic halibut on the market is generally fresher and has a longer shelf life than the

Pacific halibut. Buyers want halibut that is no more than 72 h old from time of harvest – the farmed Atlantic halibut industry can produce this. Farmed Atlantic halibut is bled which enhances shelf life, while only about half of wild Pacific halibut from Canada is bled.

Most (60%) East Coast restaurants are located in urban centers, while less than 10% are located in rural areas. These large differences in surrounding population density may cause differences in seafood purchasing behavior between regions. East Coast restaurants typically buy the vast majority of their seafood products from seafood-specific firms. Other firm types include commercial and tribal fishermen, supermarkets, and seafood specialty retailers.

West region:

In the western US market, where Pacific halibut is perceived as more of a unique product, Atlantic halibut faces the strongest competition. One strategy is to educate potential customers about Atlantic halibut, in order to let customers choose Atlantic halibut as the preferred alternative to Pacific halibut. The impact of fishing wild stocks is one good argument for farmed fish. In addition, developing Atlantic halibut cooking classes for customers in supermarkets, routinely offering demonstrations, and investing in staff development are good promotion methods. However, it is important to realize that farmed fish is viewed as not as flavorful as wild harvested fish. Marketing efforts should be made to overcome this perception.

Since 1995, the Pacific halibut fisheries in BC and Alaska have been running the exact same 245-d seasons from March to November; therefore, the other strategy is to sell farmed halibut during the months of November through March, when the wild halibut fishery is currently closed. This strategy is similar to the way farmed salmon first infiltrated new markets by selling product primarily during the off-season. Since wild halibut prices typically rise after March 15 and then decline to a lower but stable base, farmed halibut could be sold at a premium price in the 4-mo off-season of the wild fishery. In addition, it is important to advertise the advantages of farmed halibut during the November to March off-season.

5.1.2. Distribution network

Geographically, there is a huge disparity in the US market between distribution networks and regional variations in consumption habits.

Northeastern region:

New England is the main port of entry and the largest market for Canadian seafood products. Boston alone accounts for approximately 50-60 % of the regional

market. The market is looking mainly for quantity rather than quality. In the New York region, market preferences have forced suppliers to meet consumer preferences and fierce competition has obliged Canadian exporters to develop their marketing techniques and focus on competitive pricing.

Central eastern region:

The central US eastern seaboard includes Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia. There are three main markets: the Delaware Valley, the Baltimore-Washington corridor, and the Richmond-Norfolk corridor. Although Boston and New York are the largest distribution centers for seafood products destined for the central states in the eastern seaboard, markets in Philadelphia and Baltimore-Washington offer considerable potential for export businesses in Nova Scotia and New Brunswick.

Southeastern region:

The southeastern region is open to all species, which occupies more than 20% of the entire US market. Consumption of seafood products is much higher in this region than in the rest of the country because of easy access to fresh catches and a healthy tourism industry. Although the majority of fish and seafood sold in this market comes from Boston and New York, local processing plants and buyers have dealt directly with suppliers in Nova Scotia, Newfoundland, and New Brunswick. Producers in Atlantic Canada and Canadian retailers have found markets in this region for halibut. It should be noticed that quality is the determining factor in this market, whatever the species.

Midwest region:

In the midwest, target market includes Illinois, Missouri, and Wisconsin. Chicago is the center of this area, which has the highest ethnic diversity and ranks third among US cities in sales of seafood products. It offers a favorable climate for new, competitively priced products, particularly products that focus on quality, convenience, and nutrition. The city acts as a trade hub, given the vast transportation infrastructure strength. Another strength is the food services market. Therefore, Canadian producers associations are now saying that Chicago is fast becoming the seafood capital of the US.

Cleveland is located at the center of the US industrial and financial belt, including Ohio, Pennsylvania, Kentucky, and West Virginia. Canada exports a wide variety of seafood products to this area, especially fresh and frozen products, which are shipped to wholesalers directly or indirectly. Approximately 30 wholesalers located in Cleveland do business with suppliers in New Brunswick, Nova Scotia, and Newfoundland. Today, the majority of the seafood products consumed in Cleveland are purchased in Boston or Detroit. The Detroit market has excellent prospects, particularly for value-added prepared meals. Food distribution is most active in urban population centers in northern and west-central Michigan. However, some local wholesalers expressed their interest in

products from eastern Canada and in trading directly with suppliers.

California region:

California has some of the largest metropolitan population centers in the US, in particular Los Angeles and San Francisco. Given the boundless opportunities presented by such a huge market, competition among Canadian producers is fierce. Northern California is one of the major regions in the seafood product trade, since it has a huge distribution center. It is also the number two export destination, after the northeastern region, for some Nova Scotia producers.

Pacific Northwest region:

It is also an attractive market. Seattle offers a market with numerous opportunities because of the active and varied lifestyles of its inhabitants. In addition, their high incomes foster a taste for luxury imported and ready-to-serve food products.

5.1.3. Restrictions

There are a few restrictions on fish and seafood imports. Canadian producers must process in accordance with the US Food and Drug Administration's seafood hazard analysis and critical point regulations. As of April 6th, 2005, all fish and seafood retail outlets in the US must be in accordance with US Department of Agriculture's Country of Origin Labeling, which also requires producers and packers to meet new labelling guidelines.

Canada benefits from preferred access to the US markets under the North American Free Trade Agreement (NAFTA), which provides and coordinates the gradual elimination of all customs duties between the two countries. US inspection practices, considered by Canada to be somewhat arbitrary, are still a barrier to the marketing of seafood products shipped to the US, particularly exports of fresh fish, and this creates obstacles to distribution. Right now, customs duties have already been eliminated for a number of species. However, for some products such as lobster, scallops, oysters, and halibut, it is more difficult to eliminate customs duties under NAFTA.

5.1.4. Canada

Even though Canada is recognized as a major exporter of seafood products, the Canadian domestic market consumes more than 1 million MT of seafood products. Because of changes in eating habits and purchasing power, there is sustainable demand on the Canadian market. Currently, the major growth of the per capita consumption of all types of seafood product in Canada is in some centers, such as Montreal and Toronto, and in some provinces, such as BC, largely because of Asian immigration.

In eastern Canada, a lack of interest in seafood products is prevailing. There are more than 50 individual fish markets. The main market for seafood products is structured around a purchasing-pool network of major Canadian distributions, such as Atlantic Superstore and Sobey's. So far, they have developed large spaces in supermarkets for fish and seafood products specifically. The increase in sales of fresh products has encouraged distributors to maintain very wide product lines. Other places, including fish departments in grocery stores, should be developed. Furthermore, markets in eastern Canada have no distinctive character, because the standardization of product lines has caused them to follow trends in other parts of Canada and the US. In the Atlantic Provinces, distributors usually expand commercial store space in the Halifax-Dartmouth, Saint John, and Moncton areas, and rediscover local products. As a consumer market, the Atlantic provinces is a narrow market segment, because it accounts for 2 million people at most, and processed and value-added seafood products are not part of the eating habits of residents of the region.

The Quebec market is the top market in eastern Canada. The retail market in Quebec sells seafood products mainly to fish markets, grocery stores, warehouse stores, and supermarkets. In urban centers, there is a greater demand for fresh seafood products and precooked fish and seafood dishes. Quebec companies supply the provincial market through a network of brokers, wholesaler-distributors, and retailers. There are also several companies, such as Gastro-Mer, dedicated to marketing secondary- and tertiary-processed products.

Given current conditions, the market that can ensure a return on investment from marketing a line of processed products is in the Toronto and Montreal area. A large percentage of the processed products marketed in major eastern Canadian distribution networks come from establishments in the Toronto and Montreal area.

The consumption of processed seafood products in Canada is divided into two market categories; consumption at home and outside the home. Recently, the restaurant industry has accounted for more than 30% of the total consumption of the processed seafood market. It exhibits a preference for whole fresh fish, while institutional food services purchase mainly fresh and frozen fillets. Today, about 95% of the Canadian halibut catch is sold by processors in fresh form. The fresh product reaps a price premium over the frozen product. As mentioned in section 2, forecasts indicate that there will be an increase in the consumption of seafood products in Canada, with a preference for foods that are processed and prepared over those that are raw or fresh.

5.1.5. Recommendations

Figure 13 below is an illustration of each stage of a new product life cycle and how it applies to fish product.

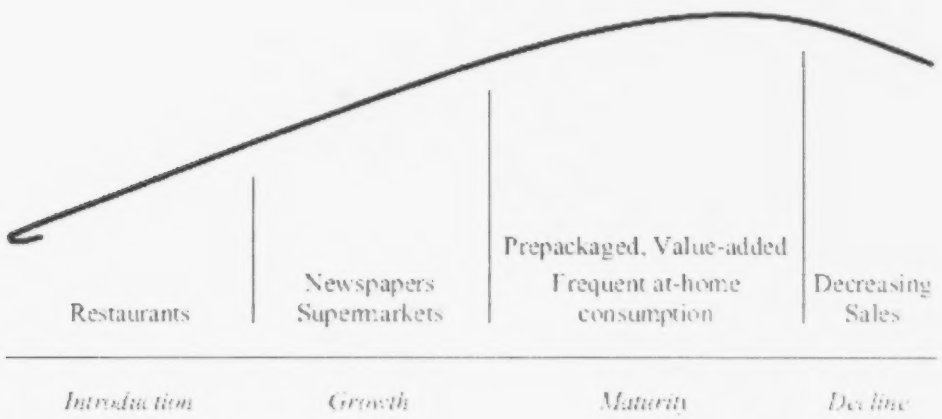

Fig. 13. The life cycle of new products.

According to its life cycle, the first recommendation is to build relationships with the restaurant chefs, who serve as the gatekeepers for what the customer will order. "Chefs are more adventurous in their preparation, and they are not shy about leading customer preference, instead of just following". By the same token, chefs need to meet the increasingly sophisticated customers' expectation. In this stage, restaurant chefs should be educated by offering suggestions for preparation and describing how farmed Atlantic halibut is similar to other species. The new species of fish is only on restaurant menus and in a few specialty fish markets. The customers who are considered innovators are the first to try the new species of fish. They, in turn, promote the new species via word of mouth.

Meanwhile, when retailers choose what products to carry in the supermarket, they visit local restaurants to see what fish products are being served and to observe the characteristics of those consumers ordering the fish products at the restaurant. Then it enters the second growth stage. The second suggestion is how to incorporate value-added fish into the supermarket. The most important aspect is to realize that value-added would not turn a profit in the first week; rather, it needs a 4- to 6-mo commitment on the shelves to build familiarity. In the self-service department, the packaging must be of high quality and durable. Supermarkets need to ensure that what is sold is ready for the consumer to eat with little or no preparation required. For fish producers, the opportunity is to be able to offer value-added products to supermarket customers at a reasonable price. The location of the value-added fish products is important, with the supermarkets' deli section as a suggested starting point. The deli is where the consumer shops for meals rather than items. In addition, the seafood counter staff in supermarkets should be educated on the major selling attributes of the product such as flavor, texture, and preparation. The

supermarkets further educate their customers with demonstrations, samples, and advertising. Newspapers and magazines learn of the new species and begin printing recipes and reviews of the new product.

In the maturity stage, the new species can be found in the prepackage section of the supermarket. At this time, the experienced customer no longer needs information about the attributes and preparation of the fish. The end consumer has adopted this species as a regular shopping item. It was suggested that in a 8 m serviced fish department, at least 20 % of that space should be devoted to valued-added items.

The third recommendation is that the packaging is a very important part of the product. The end consumer wants to see what they are buying, which implies that a see-through package may help to enhance the sale. In addition, the end consumer is looking for information on the handling, preparation, and the nutritional value of the product. Providing this information will also enhance sale revenues. When a new species of fish is introduced, it may take time for the consumer to try it. In-store demonstrations and recipe cards are each a proactive way to familiarize the consumer with the new product.

Tilapia, for example, was successfully farmed across the world and heavily distributed to the restaurants. The ample supply infiltrated the restaurant scene as more and more people tried the white, mild-tasting fish. The supermarkets noticed that the restaurants were selling tilapia with large success and began to stock their own counters with the new species. Now, tilapia can be found not only behind the seafood counter, but also in the prepackaged section along with pork and beef. Therefore, the farmer, like the distributor, can influence what is being sold to the end consumer.

As the restaurant serves as the gatekeeper for the end consumer, the distributor serves as the gatekeeper for the restaurant and supermarket. In order to realize the synergies and economics of scale in marketing, much of Canadian farmed halibut is distributed by Canadian arms of large international salmon farming companies, such as Stolt Sea Farms, Marine Harvest, and Pan Fish. These companies are in the forefront of Atlantic halibut culture. Another alternative is to cut out the middleman by dealing directly with those supermarkets, which helps to ensure that the quality and freshness of the fish are passed on to the end consumer by shortening the distribution channel. A shortened distribution channel shortens the time it takes the product to reach the end user. In addition, directly selling to the restaurants and supermarkets will potentially give the fish producers more control over setting prices and retaining some of the profit that would normally have gone to the middleman.

5.2. MIDDLE EAST

Fish consumption in the Middle East has some distinct characteristics mainly due to the fishery resource and demography of the countries. The countries of Oman and the People's Democratic Republic of Yemen (PDRY) have rich coastal marine fisheries resources and populations living predominantly along the coast; on the other hand, the countries of Jordan, Iraq, and Iran have the majority of their populations living inland with relatively well developed agriculture. Only in PDRY does consumption of fish exceed consumption of meat. In all other countries the consumption of fish is nearly 4 and 30% of the total food supply of meat and fish.

Increased industrialization has resulted in the immigration of large numbers of non-Arab expatriate workers from India, Pakistan, Sri Lanka, Philippines, and Arab expatriate workers from the Yemen, Egypt, and Lebanon. This has increased fish consumption figures and influenced consumer demand for non-indigenous fish species, plus introduced new fish preparation methods and new eating habits.

National and individual wealth has also influenced fish and shellfish consumption. In some countries it has increased the purchasing power for imported fish and fishery products, including luxury processed products. The preference throughout these countries is generally for fresh fish. However, in recent years chilled and frozen fish have become widely accepted and are now sold through retail shops and supermarkets. Cured fish are also popular but mainly in remote areas.

5.2.1. Israel

Israel is one of the largest seafood markets in the Middle East, with annual consumption of over 70,000 MT. Local production has increased dramatically during the last decade. Despite recent growth in domestic aquaculture production, 60% of the country's total seafood supply is imported. According to the Household Expenditure Survey, the total annual household expenditure for seafood had increased by 84%, from US$161.1 million in 1982 to US$296.6 million in 2002. Even though the per capita consumption of seafood has been steady for many years and totals 10.5 kg, which is half of Europe's 20 kg consumption, total seafood imports are expected to grow faster than the population over the next 5 yr, by as much as 20%. The increase in seafood consumption during the last decade is attributed to increased demand from immigrant consumption. In addition, increased household income and health food awareness has increased demand for fish.

In 2003, Israel's seafood imports totaled about US$103 million. Domestic production in 2003 accounted for 30%, while 70% was imported. Norway is the main import supplier, providing a wide variety of frozen fish products, especially salmon

products. Other countries supplying Israel's seafood market include Thailand, Kenya (frozen fillets) and Argentina (hake). The Canadian market share for total seafood import is under 1% (Table 11).

Table 11. Imports of fishery products from Canada and % of total import.

	1999	2001	2002	2003
Value($1000)	647	638	903	506
Percentage(%)	0.74	0.63	0.99	0.55

Source: Agriculture and Agri-Food Canada, 2004.

The Canada-Israel Free Trade Agreement (FTA), was implemented January 1, 1997, and improves market access for agri-food products of export interest to both Canada and Israel, and eliminates tariffs on virtually all industrial goods. It partially restored Canada's competitive position in the Israeli market where the United States and the European Union have gained preferential access through negotiated bilateral arrangements. It is expected to be amended to give access to duty-free seafood products. Currently, Canadian exporters face duties ranging between 10 and 15%, and surcharges of $555-$1,000 per MT, depending on the products and prevailing exchange rates.

Recently, Israelis have begun to eat out more and choose high quality seafood such as halibut when dining at restaurants. The private sector (households) makes up about 70% of total fish consumption, while hotels and celebrating halls make up the remainder. Out of total household expenditure on seafood, 44% and 14% are spent in marketing networks and open markets, respectively. Almost 90% of all Israeli households consume seafood. The recent influx of more than 1 million immigrants from the former Soviet Union has brought new consumer tastes into the market. Currently, consumers prefer fresh fish, but they also are increasing their demand for frozen and processed seafood. Meanwhile, the prevailing fish cooking style is based on Mediterranean cuisine, in which the whole fish is deep-fried or grilled. Methods for preparing high-quality seafood are very similar to European methods.

The best opportunities for marketing halibut are during the period of Jewish holidays, Rosh Hashanah (New Year) and Succot (Feast of Tabernacles), which are in September and October and at Passover during April. The fish processing industry will continue to increase in the next few years by 5% annually, so there are opportunities for Canadian exporters. With appropriate promotional activities, such as marketing campaigns that address the special tastes of the immigrant community, demand for Canadian fish should grow significantly.

5.3. ASIA

5.3.1. China

In the long term, the potential market for seafood in China is huge. In 2002, China imported US$1.6 billion of fishery products, which is nearly triple the value of 5 yr earlier. It is estimated that Chinese seafood imports will continue to increase at a healthy rate, in large part because of increasing interest by foreign companies to have the processing done in China where costs are much lower and a higher recovery rate can be achieved. Currently, the consumer market for seafood is primarily located in the coastal cities of China, where consumers have more disposable income and are more familiar with seafood products. Many Canadian seafood products will be geared to the high-end premium market of the affluent and middle class consumers with increasing incomes.

China's accession to the WTO will result in major reductions over the next several years to the high customs tariffs levied on imported seafood products and create excellent longer-term market prospects. Tariff reductions on major Canadian seafood export products including cold water shrimp, lobster, crab, salmon and halibut, in particular, will create significant opportunities for enhanced export levels of these products.

Market characteristics:

China is the largest fishery products output country in the world with almost 45 MT of production. About 60% of the production is aquaculture and the balance caught at sea. The per capita consumption of fishery products is not high, about 4 kg per capita in rural areas and 10 kg per capita in urban areas.

China is a vast potential market for seafood which will grow quickly as living standards of the Chinese people improve. Seafood processing is currently concentrated in coastal cities, such as Dalian and Qingdao. Due to poor nation-wide infrastructure, shortage of refrigerated equipment and short shelf life of fresh seafood, the market is primarily oriented to those cities like Beijing, Shanghai and Guangzhou. Seafood consumption in inland China is low, mainly because people's income is relatively low and general inaccessibility to seafood.

The fish products market comprises both seafood and freshwater products. Supplies come from China's own coastal waters and offshore fisheries, freshwater products grown in local waters, farmer's rice fields or ponds, as well as imported products. Due to the generally high cost of seafood, it is mainly consumed by the affluent population in coastal cities of China while freshwater products are consumed throughout China.

Foreign seafood is generally more expensive because of the importation costs.

Despite the higher prices, the younger, affluent Chinese are keen on trying out foreign seafood which may be different from domestic product. Unlike the younger generations, the older generations of Chinese are very price sensitive and, therefore, price becomes the determining factor in their purchasing decisions. Furthermore, many of the older generations prefer to shop at traditional markets where there are fewer opportunities to know the origins of the seafood. Seafood sold at these markets is either fresh or alive in barrels of water. They are not packaged or labeled with information about the products' geographic origin and nutritional value. In general, consumers prefer live seafood. When live seafood is too expensive, frozen seafood is the next choice, followed by canned or dried seafood products like dried cuttlefish, a very popular Chinese snack.

Other seafood market opportunities available to foreign exporters are related to the local market preferences in China. For example, Chinese traders are interested in fish heads and bellies which are usually discarded or sold at minimal prices in North America when fish is processed for fillets. Meanwhile, there is a good market for "undersized" fish. In China, a 200- to 500-g fish, with its head and tail on, is regarded as the perfect size for steaming, a popular way to cook fish in China. There is a large variety of foreign seafood in the local market and suppliers include Canada, the United States, Denmark, Russia, Iceland, Ecuador, Thailand, Indonesia, Australia and Norway. There is no single dominant supplier of seafood products.

Canadian companies are exporting primarily crab, shrimp, herring, salmon, geoduck and hokkigai clams, livers and roes to China. The market for Canadian fish and seafood products is in the larger affluent cities such as Beijing, Shanghai, and Guangzhou. The primary end users of Canadian product are the higher end hotels and Chinese seafood restaurants.

China's seafood imports:

China's imports of seafood products have increased at a dramatic rate during the past 5 yr, nearly tripling in volume to US$1.6 billion in 2002. The high import duty rates on seafood products have encouraged many importers to find methods to evade tariffs by shipping their goods via Hong Kong to China without the normal documented records. Consequently, official figures from the Chinese government regarding China's seafood imports may not be accurate because some seafood imports enter China through grey channels. It is expected that this diversionary process will be used less as the tariffs reduce significantly under China's accession to the WTO and Customs laws are more vigorously enforced.

Canadian seafood exports to China have grown dramatically over the last 5 yr, having increased more than four-fold from $50 million in 1997 to $207 million in 2002. Crab and shrimp are the major export items, while halibut has attracted more and more

interests during the last several years (Table 10).

Table 10. Value of Canadian seafood exports to China (C$ millions)

Product	1999	2000	2001	2002
Halibut/turbot	-	0.2	1.7	5.8

Source: Agriculture and Agri-Food Canada. 2006b.

After arriving at the ports, frozen seafood products destined for retail markets are shipped via China's railway and highway transportation network to the various cities for sale. The distribution chain is as follows: the primary importers sell to local first-level wholesalers, who then transfer product to dealers, who in turn sell to retailers. The main retail venues for seafood in China are the wet markets and food stores; however, much of the imported product would be sold through supermarkets or high end hotel and restaurants.

In addition to frozen seafood, there is a smaller but substantial market for live seafood in China. Live seafood products are shipped by air and the main points of entry are Beijing and Shanghai. Among the many live seafood products entering China are Dungeness crab, oysters, lobster, and geoduck clams from Canada, rock lobsters from Australia, and oysters from New Zealand. China's high seafood tariffs have been a significant impediment to long-term growth of imports to China. However, China's accession to the WTO has resulted in major reductions for a wide range of seafood products of interest to Canada as shown in Table 11.

Table 11. Chinese tariffs on selected seafood products. Tariff rates (%).

Product	**2002**	**2003**	**2004**	**2005**
	Frozen (excl fillets)			
Halibut	14	12	10	10
Fillets				
Fresh or chilled	18	16	15	12
Frozen	18	16	13.3	10
	Dried, salted, brine, smoked			
Smoked salmon	20.4	17.2	14	14
Smoked herring	21.6	18.8	16	16

Source: Agriculture and Agri-Food Canada. 2006b.

5.3.2. Japan

Japan is a large and lucrative market of choice for all the world's food exporting nations and a market of critical importance to Canadian farmers, food processors and

exporters. The Japanese consume over 72 kg of seafood per capita annually, more than five times the world average. Generally, out of Japan's total fish consumption of approximately 10 million MT, domestic fishermen can only supply 60%, thereby resulting in a dependency on imports for the balance.

Japanese domestic prices for fish and fisheries products had been adversely affected by the Japanese economy recession since 1993, after the crush of Japanese bubble economy. The prolonged economic slowdown and the depreciated yen resulted in the first ever decrease (3%) in the volume of Japanese imports of fish and seafood in 1997. Intensified pressure on fish imports in 1998 resulted in a further 10% contraction in imports. The expenditures on fish and fisheries products per house were 106,101 yen in 2001, lower than 108,692 yen in 1977, which had continued to decrease for nine consecutive years. Coupled with a "restructuring of companies", consumers' sense of uncertainty for their future had been curtailing a substantial portion of their spending. The spending on food, including fish and fisheries products, was not an exception to this. As a result of these circumstances, prices of fish and fisheries products remained at relatively low levels.

Despite such an economic situation, Japan's 2002 imports of fish and fisheries products recorded a historic high level, with almost the same volume and value as in 2001. The deflationary economy of Japan has had adverse effects on the purchasing power of Japanese importers. However, the economy is recovering steadily, supported by business investment and exports. In the market, expensive fish and fisheries products have started to sell well again. Meanwhile, it is reported that the outbreak of mad cow disease had positive effects on the consumption of fish.

Imports from Canada:

Japan is Canada's second-largest foreign market for seafood (22% of total fish exports) products after the United States. However, Canadian seafood exports have not escaped the downturn in the Japanese market (Table 12). Fluctuation in currency values made high value Canadian seafood exports more expensive for Japanese importers in both 1997 and 1998. Nevertheless, for Canadian agri-food and fish exporters, Japan remains a vast, but untapped market. By providing an outlet for Canada's "non-traditional" and "under-utilized" species, it has offered a critically important lifeline for Canada's east coast fishery since the collapse of the groundfish stocks.

Table 12. Japanese imports of fish and fisheries products, 1994-2004 (MT)

	Units	1994	1999	2003	2003	2004
Volume	MT (thousands)	3,295	3,416	3,325	3,485	-

Value	Yen (100 million)	17,091	17,395	15,692	16,371	16,683

Source: USDA, 2006 GAIN Report.

Market characteristics:

It is important to note that Japan is not one homogeneous consumer market. There are distinct regional differences, especially with regard to food preferences between consumers residing in the Kanto or eastern (Tokyo and environs) and the Kansai or western (Osaka, Kobe, Kyoto, Nara) regions. In the Kansai region, consumers are known to be more demanding, wanting the tastiest foods at the lowest price. Furthermore, traders of food products in the Kansai tend to be cautious about introducing new or unfamiliar products into the market but, after they are certain of consumer acceptance, become more serious in promoting new products.

Japanese consumers have always expected safe, high quality, tasty food items but, like their North American counterparts, they also now demand convenience, value and a healthy image (particularly lower fat and salt content). The Japanese are eating a wider variety of foods and more ready-to-serve items. While reduced prices were once synonymous with lower quality, the current decade has witnessed greater price sensitivity and increasing preference for lower priced, but still high quality items. Compared with only 5 yr ago, Japan's affluent and aging consumers have become increasingly global in their tastes, value conscious in their purchasing, and health conscious in their selections.

International and domestic transportation networks are vital for the efficient distribution of products to regional markets. Regional imports of fresh products have been increasing, and this is attributable to the advancement of air networks as well as to the market needs. The new Kansai International Airport, which opened in September 1994, has made the Kansai market more attractive for overseas exporters, especially for handling perishable products such as meat, vegetables and fruits, and live products like flowers. Direct air links between Canada and Kansai are an advantage for the sale of fresh products from Canada. One of the frequent challenges of developing regional markets outside the Kanto and Kansai areas is the need to establish linkages between locally based wholesalers and distributors and Tokyo or Osaka based importers of Canadian products.

Tariff and related regulations:

In the case of agri-food, fish and beverage exports, average import tariffs not only remain very high, there is significant tariff escalation as products proceed from raw or fresh to further processed forms. Canada will seek significant reductions in these tariffs during the new round of multilateral trade negotiations which was scheduled to commence during the latter part of 1999.

Japan's Tariff Schedules provide for a reduced import tariff for fish feed which is

packaged in "airtight" containers. However, the Ministry of Finance has issued a "prescriptive" definition of an airtight container (i.e., aluminum bags only) for the administration of this "performance-based" requirement. Canada has requested that any container that is certified by a recognized laboratory as meeting the technical standards for "airtight" be eligible for the duty-free access provision.

The Japanese Ministry of Agriculture, Forestry and Fisheries has proposed regulations that would require the mandatory labelling of genetically modified organisms. It requires that all varieties of genetically modified plants undergo environmental field testing in Japan. The Canadian authorities have requested that varieties which have received environmental approval in Canada and are intended only for processing be exempt from this requirement, particularly if Japan has already generated data on the environmental attributes of the particular genetic combination in other varieties of the same recipient species.

Recommendation:

For Canada to gain market share in Japan, committed companies with locally adapted, quality products are essential. The Japanese fish import system restricts worldwide imports of certain species of fish. However, special arrangements facilitate the import of Canadian (and American) fish subject to quotas. Under these arrangements, import licenses will be issued to Japanese importers of fish and seafood if they can demonstrate that they are willing to purchase Canadian seafood products and have identified a Canadian company willing to export to them, a situation known as "willing buyer/willing seller." In those cases where there is an existing quota (including a "basket" quota) for under-utilized or "new" species, the species would qualify for the automatic issuance of import licenses under the Canada-Japan understanding. In the case of an under-utilized or "new" species for which there is no existing quota, usually the only access consideration would be the import tariff. If Canadian exporters refer any interested Japanese buyers to the Canadian Embassy in Tokyo, they will receive assistance in rapidly obtaining the necessary import authorization. Meanwhile, experience has demonstrated that one of the most effective means of achieving this objective is to identify and support local chefs or retailers who are prepared to "champion" Canadian products and then to work backwards through their respective supply chains. Once a local distributor begins handling and promoting a new agri-food, fish or beverage product at the request of one of Canada's regional "champions," it is then possible to promote the same product(s) to others in the same area.

In addition, exports from more Canadian companies and a greater variety of value-added products are required to boost consumer awareness of Canada as a food provider. While trade and consumer perceptions of Canada are generally positive, the Canadian industry is still not perceived as being sufficiently responsive to Japanese needs

in the areas of product adaptation, competitive pricing, and customer relationships.

Resource constraints on both coasts of Canada, increased production by other suppliers and price resistance to "luxury" seafood products constitute the greatest current challenges to Canadian seafood exporters. Canadian exporters must compete with aggressive in-roads into the Japanese market that are being made by the Norwegians, Chileans and Russians, while effectively managing the Canadian fisheries to ensure stable, high-quality supply as a prerequisite for maintaining or increasing market share.

5.3.3. Korea

Fish and marine products are an important component of the Korean diet. Korea developed a powerful fisheries industry by intensively exploiting its inshore fishery sector and establishing a large offshore fishery capability that actively sought opportunities worldwide. The production-oriented policy has led to the overexploitation of coastal and offshore fishery resources. The politics of the international fisheries has reduced Korean access to remaining offshore stocks. As a result, Korean fishery production began to decline significantly in the 1990s. Since 1995, Korea has been relying heavily on imported fish and other seafood. The total size of the fish and seafood market based on production in Korea is around 2.5 million MT. The estimated value of fish and seafood import market in 2002 was CAN$1.2 billion, of which approximately $27.3 million was from Canada.

Marine fish represent the main growth sector due to the strong demand for raw fish. Usually live fish are sold to fish mongers in the open markets as well as to hotels and upper-class Japanese restaurants for making raw dishes (sashimi or sushi). The total market for live fish sector in 2002 was estimated at US $103 million. Korean buyers tend to buy based on price rather than quality. The consumption of fresh halibut is extremely limited due to its high costs. Smoked halibut is mainly consumed in tourism hotels, family restaurants and buffet restaurants and department stores/discount outlets. Frozen halibut imports are being used for domestic smoking purposes.

Consumption patterns are changing rapidly for certain food products among the younger Koreans. The growth of an affluent middle class in Korea has recently led to a burgeoning market for some seafood products. With the rapid growth of the Hotel, Restaurant and Institution (HRI) business in Korea, the demand for frozen, low-priced species should be strong in the future.

Tariff and related regulation:

Fish and seafood items can be freely imported without any market restrictions. There is no tariff quota system on imported fish and seafood. The bidding system on fish products has been eliminated. In many cases, individual fish buyers base their purchasing decisions on cost rather than quality and freshness.

Recommendation:

Canada has been able to maintain a very positive image in Korea with respect to fish and seafood quality. Canadian suppliers should continue to maintain the current quality standards at reasonable prices.

6.0. CONCLUSIONS

Aquaculture in Atlantic Canada brings jobs and incomes to relatively depressed regions, and for society in general, plus taxes and support to isolated rural communities. Reliance on a single species creates economic risks, and to ensure the future viability of the industry in eastern Canada, diversification into alternative species is a reasonable strategy for the industry itself, and for governments. Possible species include Atlantic halibut, Atlantic cod and haddock.

The market potential for all three whitefish species in North America is considerable. Population growth will itself generate demand but this will be reinforced by rising per capita consumption caused by higher real disposable incomes and overall demographic aging. On the supply side, all three species face stagnation, if not a decline, in landings from the capture fisheries.

The market potential for Atlantic halibut is particularly positive. It is a luxury product with income elasticity coefficients in excess of 4. It is price elastic which is encouraging for the aquaculture industry. On the one hand price, elasticity ensures that farm incomes will rise even if the price of the product were to fall; on the other hand, increases in supply, perhaps coming from aquaculture, will not cause a disproportionate decline in price. In 2005, farmed halibut accounted for a quarter of total supply; the market should be able to absorb further increases without a decline in farmers' incomes. Atlantic halibut shares with salmon a reputation as a fish rich in omega-3 fatty acids; it also has a firm flesh. Increased output may cause a decline in retail prices as with Atlantic salmon, but farmers will reduce costs thanks to the learning curve and improved technology.

As with Atlantic salmon that is marketed globally, the market for Atlantic halibut could be international. Rising per capita incomes in the Middle East and Asia will generate a demand for high quality fish, particularly if it can be sold "fresh". However, transport costs mitigate against selling fresh products a long distance. For this reason, the most appropriate market (initially at least) for the relatively small quantities that will come from eastern Canada is North America. The northeastern US market is familiar to eastern Canadian farmers, and distributors, whether superstores or restaurants, apparently welcome deliveries of quality fish that is consistent and reliable. This is the channel recommended in this report.

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